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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN: 0648-XZ14

Takes of Marine Mammals Incidental to Specified Activities; Navy Training Conducted at the Silver Strand Training Complex, San Diego Bay

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice of issuance of an incidental harassment authorization.

SUMMARY: In accordance with provisions of the Marine Mammal Protection Act (MMPA) as amended, notification is hereby given that an Incidental Harassment Authorization (IHA) has been issued to the U.S. Navy (Navy) to take marine mammals, by harassment, incidental to conducting training exercises at the Silver Strand Training Complex (SSTC) in the vicinity of San Diego Bay, California.

DATES: This authorization is effective from July 18, 2012, until July 17, 2013.

ADDRESSES: A copy of the application, IHA, and/or a list of references used in this document may be obtained by writing to P. Michael Payne, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910-3225.

FOR FURTHER INFORMATION CONTACT: Shane Guan, NMFS, (301) 427-8401, or Monica DeAngelis, NMFS, (562) 980-3232.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 et seq.) direct the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) if certain findings are made and regulations are issued or, if the taking is limited to harassment, notice of a proposed authorization is provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such taking are set forth. NMFS has defined "negligible impact" in 50 CFR 216.103 as: "…an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

The National Defense Authorization Act of 2004 (NDAA) (Public Law 108-136) removed the "small numbers" and "specified geographical region" limitations and amended the definition of "harassment" as it applies to a "military readiness activity" to read as follows (Section 3(18)(B) of the MMPA):

(i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or

(ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Section 101(a)(5)(D) establishes a 45-day time limit for NMFS review of an application followed by a 30-day public notice and comment period on any proposed authorizations for the incidental harassment of marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny the authorization.

Summary of Request

NMFS received an application on March 3, 2010, and subsequently, a revised application on September 13, 2010, from the Navy for the taking, by harassment, of marine mammals incidental to conducting training exercises at the Navy's Silver Strand Training Complex (SSTC) in the vicinity of San Diego Bay, California. On October 19, 2010, NMFS published a Federal Register notice (75 FR 64276) requesting comments from the public concerning the Navy's proposed training activities along with NMFS' proposed IHA. However, on March 4, 2011, three long-beaked common dolphins were found dead following the Navy's mine neutralization training exercise involving time-delayed firing devices (TDFDs) at SSTC, and were suspected to be killed by the detonation. In short, a TDFD device begins a countdown to a detonation event that cannot be stopped, for example, with a 10-min TDFD, once the detonation has been initiated, 10 minutes pass before the detonation occurs and the event cannot be cancelled during that 10 minutes. Subsequently, NMFS suspended the IHA process for SSTC and worked with the Navy to come up with more robust monitoring and mitigation measures to prevent such incidents. On July 22, 2011, the Navy submitted an addendum to its IHA application which includes additional information and additional mitigation and monitoring measures for its proposed mine neutralization training exercises using TDFDs at SSTC to ensure that the potential for injury or mortality is minimized. On March 30, 2012, NMFS published a supplemental Federal Register notice for the proposed IHA (77 FR 19231) with enhanced mitigation and monitoring measures for training exercises using TDFDs and additional information on marine mammal species in the vicinity of the STCC.

Since there was no change made to the proposed activities, the description of the Navy's proposed SSTC training activities is not repeated here. Please refer to the Federal Register notices (75 FR 64276; October 19, 2010; 77 FR 19231; March 30, 2012) for the proposed IHA and its modification.

Comments and Responses

A notice of receipt and request for public comment on the application and proposed authorization, and for public comment on enhanced monitoring and mitigation measures for the use of TDFDs were published on October 19, 2010 (75 FR 64276) and on March 30, 2012 (77 FR 19231). During the 30-day public comment periods, the Marine Mammal Commission (Commission) and a private citizen provided comments.

Comments from October 19, 2010, Federal Register Notice:

Comment 1: The Commission requests NMFS to require the Navy to revise density estimates and subsequent number of takes to reflect accurately the densities presented in the references or provide a reasoned explanation for the densities that were used. The Commission specifically points out that in general, the densities for California sea lions, harbor seals, and gray whales in Table 3-1 of the IHA application are inconsistent with Table 3.9-3 of the reference (DoN 2008). In addition, the Commission points out that in the case of bottlenose dolphins, the reference (National Centers for Coastal Ocean Science 2005) does not explicitly provide density estimates for this species and should not be cited as a direct source for these estimates.

Response: NMFS believes that the Navy's density estimates and subsequent number of takes used in the IHA application accurately reflect the densities presented in the references and are appropriate, although NMFS and the Navy concur that an error was made in Table 3-1 of the IHA application regarding the sources of marine mammal densities. The Navy points out that marine mammal density data actually came from Carretta et al. (2000), rather than from the Southern California (SOCAL) Range Complex Environmental Impact Statement / Overseas Environmental Impact Statement (EIS/OEIS) as stated in the IHA application. The title of the reference is "Distribution and abundance of marine mammals at San Clemente Island and surrounding offshore waters: Results from aerial and ground surveys in 1998 and1999" (specifically from Table 5, page 22 of the document) and is coauthored by J. V. Carretta, M. S. Lowry, C. E. Stinchcomb, M. S. Lynn and R. E. Cosgrove, and was published by NMFS Southwest Fisheries Science Center (SWFSC) in La Jolla, California. The density values shown in Table 3-1 were correctly used from Carretta et al. (2000) although rounded to two significant digits.

Regarding pinniped density data, the Navy specifies that Carretta et al. (2000) represents one of the few systematic regional at-sea surveys for pinnipeds within Southern California. NMFS currently does not conduct pinniped at-sea assessments and instead relies on land based counts for its stock assessment reports, and there is no other published Southern California pinniped at-sea density information that the Navy or NMFS is aware of. Therefore, Carretta et al. (2000) is a considered the best available science for such data.

Regarding gray whale density data, these were modified from Carretta el al. (2000) during 2006 when the Navy began to prepare the SSTC EIS and subsequent IHA application by

NMFS SWFSC. This is reflective of the limited nature of transitory gray whale presence within the very nearshore habitat of SSTC.

Bottlenose dolphin density information was derived from NMFS SWFSC sighting data for the coastal stock of this species. The data show estimated encounter rate in number of dolphins per kilometer (km) for distinct segments along the California coastline, including the coastal area of SSTC. The Navy used the encounter rates along the shore adjacent to SSTC and given as referenced within the IHA application that this stock is normally thought to reside within 1 km of the coast, used the NOAA values for density in km squared (0.202 individual per km x 1 km = 0.202 individual per km^2).

In addition, the Navy contacted the leading experts at NMFS SWFSC on the coastal stock of bottlenose dolphins in response to the Commission's comment, and these experts confirmed that there were no traditional NMFS DISTANCE methodology density estimates available for the coastal stock of bottlenose dolphins available from NMFS. While NMFS research continues on this stock, the primary tool is visual sighting and photographic comparison, with much data still unpublished. NMFS SWFSC confirmed that the stock, while likely of higher occurrence south of Point Conception, has a very fluid distribution from south of San Francisco to some unknown distance down the Baja peninsula. There are likely significant variations daily, annually, and inter-annually influencing distribution along the coast that are as yet not fully understood but certainly linked to oceanographic conditions as they influence prey availability. The Navy states that based on discussion with other NMFS SWFSC experts, use of the National Centers for Coastal Ocean Science publication as a source of published values for density of the coastal stock of bottlenose dolphins was appropriate. This publication did list encounter rate (density) in a range from 0.202 to 0.311. The Navy in the SSTC IHA application selected the

0.202 value given the anticipated limited occurrence of coastal bottlenose dolphins within the small spatial extent (approximately 6.5 km of ocean-side shoreline) in which the SSTC training activities being sought for authorization occur. In addition, as pointed out by experts from the Scripps Institution of Oceanography (SIO), most of the current research on this stock is focused on coastal dolphins surveys from Point Loma north. There is no or limited recent effort near SSTC. Finally, for the coastal stock of bottlenose dolphins (and all marine mammal densities used) the Navy's modeling process assumes a constant presence and density of each stock or species specifically within the SSTC action area, when in reality as discussed at length in the IHA application and briefly above, there will be times when no marine mammals including bottlenose dolphins will be present. In conclusion, NMFS believes that given the uncertainties of dolphin distribution within SSTC, and the conservative assumptions used by the Navy's model (that dolphins are always present), the 0.202 density value is justified within the context of the SSTC IHA application, and that the other densities discussed in this response (pinniped and gray whale) are also scientifically justified.

Nevertheless, following the incident of common dolphin mortalities that resulted from the use of TDFDs during a training exercise, the Navy and NMFS reassessed the species distribution in the SSTC study area and included four additional dolphin species. These species include long-beaked common dolphins (Delphinus capensis), short-beaked common dolphin (D. delphis), Pacific white-sided dolphin (Lagenorhynchus obliquidens), and Risso's dolphin (Grampus griseus), and have been sighted in the vicinity of the SSTC training area, but much less frequently.

Comment 2: The Commission requests NMFS require the Navy to conduct external peer review of marine mammal density estimates, the data upon which those estimates are based, and the manner in which those data are being used.

Response: As discussed in detail in the Response to Comment 1, the marine mammal density data used in the SSTC IHA application and the Federal Register notice (75 FR 64276; October 19, 2010) for the proposed IHA were reviewed by NMFS Regional and Science Center experts as well as by scientists from SIO. These reviews support the reliability of the data being used in making take estimates.

Comment 3: The Commission requests that NMFS only issue the IHA contingent upon a requirement that Navy first use location-specific environmental parameters to re-estimate safety zones and then use in-situ measurements to verify, and if need be, refine the safety zones prior to or at the beginning of pile driving and removal.

Response: During processing of the Navy's IHA application, and through the formal consultation between the Navy and NMFS Southwest Regional Office (SWRO) on Essential Fish Habitat, the Navy will be required to conduct an in-situ acoustic propagation measurement and monitoring for pile driving and removal during the first training deployment of the ELCAS at the SSTC. This acoustic measurement and monitoring will provide empirical field data on ELCAS pile driving and pile removal underwater source levels, and propagation specific to environmental conditions and ELCAS training at the SSTC. These values will be used to refine the safety zones prior to or at the beginning of pile driving and removal, and to inform subsequent consultations with NMFS in an adaptive management forum. Therefore, the Navy is already required to use location-specific environmental parameters to re-estimate safety zones and then use in-situ measurements to verify, and if need be, refine the safety zones prior to or at the beginning of pile driving and removal.

Comment 4: The Commission requests that before issuing the authorization, NMFS require Navy to use consistent methods for rounding fractional animals to whole numbers to determine takes from underwater detonations and pile driving and removal, and re-estimate marine mammal takes using the same methods for all proposed activities.

Response: NMFS has reviewed the Navy's process for modeling and estimating numbers of marine mammals that could be exposed to sound from underwater explosions and pile driving related training activities at SSTC, and also discussed with the Navy the method by which the take numbers were calculated. Based on the review and discussion, NMFS believes that the Navy's modeling and calculation of marine mammal takes from underwater detonations and pile driving and removal are consistent and conservative. Specifically for the SSTC IHA application pile driving and removal calculations, the Navy elected to apply a conservative and over-predictive process of "rounding up" to the next whole number any fractional exposures to generate the largest possible exposure given variations in marine mammal densities as discussed in Response to Comment 1. NMFS believes that the Commission's comment is probably due to the lack of detailed description of the ELCAS take calculation in the Navy's IHA application and the Federal Register notice (75 FR 64276; October 19, 2010) for the proposed IHA. A detailed description along with a calculation example is provided later in this document.

Comment 5: The Commission requested that NMFS require the Navy to monitor for at least 30 minutes before, during and at least 30 minutes after all underwater detonations and pile driving and pile removing activities.

Response: The proposed mitigation measures in the Federal Register notice (75 FR 64276; October 19, 2010) for the proposed IHA already called for monitoring for marine species 30 minutes before underwater detonations, and 30 minutes after underwater detonations. Monitoring during the training event would be continuous. The only exception is for the much smaller charge weight shock wave action generator (SWAG) event (0.03 lbs) where the before and after monitoring period is 10 minutes, due to its small zones of influence (60 yards or 55 m for TTS at 23 psi in warm season and 40 yards or 37 m in cold season; 20 yards or 18 m for TTS at 182 dB re 1 μPa^2-sec in both warm and cold seasons). NMFS feels that 10 minutes is adequate given the very small charge weight, smaller zones for easy visual monitoring, and extremely unlikely injury or mortality from this kind of event.

Enhanced monitoring measures concerning detonations that involve TDFDs are discussed below.

The Navy originally proposed to monitor for 30 minutes prior to ELCAS pile driving or pile removal and monitoring through pile driving and removal activities, but not post-activity because there is little likelihood of marine species mortality or injury from pile driving and removal. However, NMFS agrees with the Commission that the Navy should conduct monitoring 30 minutes after ELCAS pile driving and removal to ensure that no marine mammals were injured or killed by these activities. NMFS believes that post pile driving and removal monitoring is warranted due to the large zones of influence for pile driving and removal and because marine mammals could be missed by visual monitors. Therefore, 30 minutes of post pile driving and removal monitoring is required in the IHA NMFS issued to the Navy, and the Navy has incorporated this requirement into its latest IHA application submitted on December 28, 2010.

Comment 6: The Commission requests NMFS require the Navy to take steps to ensure that safety zones for pile driving and removal are clear of marine mammals for at least 30 minutes before activities can be resumed after a shutdown.

Response: As it described in detail in the Federal Register notice (75 FR 64276; October 19, 2010) for the proposed IHA, isopleths corresponding to 180 dB re 1 μPa from impact pile driving are 46 yards (42 m) from the source. The Navy proposes a safety zone (or mitigation zone in the Navy's IHA application) of 50 yards as a shutdown zone for marine mammal mitigation. NMFS believes that in such a small zone, visual monitoring can be easily and effectively conducted to ensure that marine mammals have cleared the area after a shutdown measure has been called. Therefore, it is unnecessary for the Navy to wait for 30 minutes before activities are resumed after a shutdown. In addition, the Navy states that imposing a 30 minute post-shutdown resumption time interval would have significant negative training impacts because there is only a small window allowed for ELCAS construction to meet training objectives.

Therefore, NMFS does not agree with the Commission, nor considers it necessary, to impose a 30-minute post-shutdown waiting time to clear marine mammals.

No safety zone would be established for pile removal since the isopleths corresponding to 180 dB re 1 μPa is at the source.

Comment 7: Pending the outcome of an exploration of options to assess the efficacy of soft-starts during pile driving and removal, the Commission requests NMFS to require Navy to make observations during all soft starts to gather the data needed to analyze and report on the effectiveness of soft-starts as a mitigation measure.

Response: The "soft start" provision associated with ELCAS pile driving is one of the mitigation measures required for this activity. Although the efficacy of soft starts has not been assessed, it is believed that by increasing the pile driving power incrementally instead of starting with full power, marine mammals that were missed during the 30-minute pre pile driving monitoring would leave the area and avoid receiving TTS or PTS. NMFS agrees with the Commission that an evaluation of efficacy is warranted. However, given the limited nature of actual pile driving, and overall low marine mammal densities and occurrence within parts of SSTC where ELCAS would be used, NMFS does not believe that mandating a soft start effectiveness analysis would be meaningful or provide enough verifiable data to make any sort of reliable, scientific conclusion based on the ELCAS pile driving. Nevertheless, NMFS will require the Navy to instruct potential ELCAS monitoring personnel to note any observations during the entire pile driving sequence, including "soft start" period, for later analysis.

Comment 8: The Commission requests NMFS to condition the authorization, if issued, to require suspension of exercises if a marine mammal is seriously injured or killed and the injury or death could be associated with those exercises, and if additional measures are unlikely to reduce the risk of additional serious injuries or deaths to a very low level, require Navy to obtain the necessary authorization for such takings under MMPA.

Response: Though NMFS largely agrees with the Commission, it should be noted that without detailed examination by an expert, it is usually not feasible to determine the cause of injury or mortality when an injured or dead marine mammal is sighted in the field. Therefore, NMFS has required in its IHA that if there is clear evidence that a marine mammal is injured or killed as a result of the proposed Navy training activities (e.g., instances in which it is clear that munitions explosions caused the injury or death) the Naval activities shall be immediately suspended and the situation immediately reported by personnel involved in the activity to the officer in charge of the training, who will follow Navy procedures for reporting the incident to NMFS through the Navy's chain-of-command.

For any other sighting of injured or dead marine mammals in the vicinity of any of Navy's SSTC training activities utilizing underwater explosive detonations for which the cause of injury or mortality cannot be immediately determined, Navy personnel will ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as operational security allows). The Navy will provide NMFS with species or description of the animal(s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available).

Comment 9: The Commission requests NMFS ensure that discrepancies between the Navy's application and NMFS' Federal Register notice (75 FR 64276; October 19, 2010) for the proposed IHA are corrected and addressed in the authorization.

Response: During the SSTC IHA application review and process, the Navy made two updates to the original February 16, 2010, application to provide an enhanced description of training events, and reflect substantive content from discussion with NMFS. The first update was on September 1, 2010 and the second update on November 4, 2010. Both updates were integrated into the final review by NMFS when making the determination to issue the IHA. NMFS has therefore corrected and addressed all inconsistencies among different IHA application stages and NMFS' Federal Register notice (75 FR 64276; October 19, 2010) for the proposed IHA.

Comments from March 30, 2012, Federal Register Notice:

Comment 10: The Commission requests NMFS require the Navy to model the various proposed monitoring schemes to determine what portion of the associated buffer zone is being monitored at any given time and the probability that dolphins entering that buffer zone would be detected before they get too close to the detonation site.

Response: In the fall of 2011, the Navy funded the Center for Naval Analysis (CNA) to examine this issue. CNA was asked to: (1) Analyze the Navy's mitigation approach (estimate the probability of marine mammals getting within the explosives safety zone without being detected, for various scenarios; (2) Determine what mathematical methods are appropriate for estimating the probabilities of mammals entering the various safety zones undetected; (3) Using the mathematical methods determined above, how effective are the Navy's mitigation procedures in protecting animals; and (4) Determine what are the effects of various factors such as: size of explosive charges, footprint of impact zones, travel speeds of various marine mammals, number and location of Navy observers.

CNA validated that a geometric approach to the problem would help in assessing the study questions outlined above, and its final conclusions on the Navy's proposed TDFD mitigations were:

- Explosive harm ranges for the charge sizes under consideration are driven by the 13 psi-ms acoustic impulse metric, corresponding to slight lung injury;
- Fuse delay and animal swim speeds strongly drive results regarding mitigation capability;
- Probability of detection of all animals (Pd):

- For TDFD mitigation ranges out to 1,000 yards, Pd would be close to 100% for 2-boats and 5-minute delay for charge weights up to 20-lb net explosive weight (NEW);
- For TDFD mitigation ranges of 1,400/1,500 yards, likely Pd would be > 95-99% for 3-boats and 10-minute delay for charge weights up to 20-lb NEW.

- A three-boat effort is sufficient to cover most cases.

In terms of how the CNA analysis relates to the SSTC training activities, please see Response to Comment 12.

Comment 11: The Commission requests NMFS require the Navy to (1) measure empirically the propagation characteristics of the blast (i.e., impulse, peak pressure, and sound exposure level) from the 5-, 10-, and 15- to 29-lb charges used in the proposed exercises; and (2) use that information to establish appropriately sized exclusion and buffer zones.

Response: In 2002, the Navy conducted empirical measurements of underwater detonations at San Clemente Island and at the Silver Strand Training Complex in California. During these tests, 2 lb and 15 lb NEW charges were placed at 6 and 15 feet of water and peak pressures and energies were measured for both bottom placed detonations and detonations off the bottom. A finding was that, generally, single-charge underwater detonations, empirically measured, were similar to or less than propagation model predictions. Based on SSTC modeling, many of the mitigation zones by NEW proposed in the Navy's original SSTC IHA application of February 2010 were much smaller than the zones proposed in the Navy's SSTC IHA application addendum of October 2011.

As part of agreement on monitoring measures between NMFS and the Navy, the Navy will annually monitor a sub-set of SSTC underwater detonations with an additional boat containing marine mammal observers comprised of Navy scientists, contract scientists, and periodically NMFS scientists. The Navy will explore the value of adding field measurements during monitoring of a future mine neutralization event after evaluating the environmental variables affecting sound propagation in the area, such as shallow depths, seasonal temperature variation, bottom sediment composition, and other factors that would affect our confidence in the data collected. Further, the Navy states that if such data can be collected within existing programmed funding for SSTC monitoring (i.e., costs) and without impacts to training, the Navy will move forward in incorporating one-time propagation measurements into its monitoring program for SSTC underwater detonations training.

Comment 12: The Commission requests NMFS require the Navy to re-estimate the sizes of the buffer zones using the average swim speed of the fastest swimming marine mammal that inhabits the areas within and in the vicinity of SSTC where TDFSs would be used and for which taking authorization is being requested. The Commission states that animals swimming faster than 3 knots could easily be at increased risk. Providing peer-reviewed papers by Lockyer and Morris (1987), Mate et al. (1995), Ridoux et al. (1997), Rohr et al. (1998), and Rohr and Fish (2004), the Commission points out that many marine mammals are capable of swimming much faster than 4 knots, especially during short timeframes.

Response: NMFS does not agree with the Commission's assessment that the sizes of the buffer zones be established based on average swim speed of the fastest swimming marine mammals. While the Commission quotes higher swim speeds, the behavioral context of the speeds should be considered. Just because an animal can go faster does not mean that it will. A better citation than one provided by the Commission (Rohr et al. 1998) is perhaps Rohr et al. (2006). Speeds reported are in terms of maximum for a captive long-beaked common dolphin, and for wild long-beaked common dolphin evoked by low passes from an airplane recording their reaction (Rohr et al. 2006). Maximum speeds are energetically expensive for any organism and usually not maintained for long. Unpublished observations of marine mammals within the SSTC boat lanes during the Navy 2011 and 2012 surveys have documented mostly small groups of slow moving, milling coastal stock of bottlenose dolphins and California sea lions. The occurrence of more pelagic species (long-beaked common dolphins, Pacific white-sided dolphins, Risso's dolphins, and short-beaked common dolphins) is predicted to be less likely and limited in duration. Navy included these species in the SSTC IHA application addendum as a conservative measure.

Further expansion of the buffer zones is not warranted because: (1) the current buffer zones already incorporate an additional precautionary factor to account for swim speeds above 3 knots; and (2) buffer zones greater than 1,000 yards for events using 2 boats, and 1,400/1,500 yards for events using 3 boats or 2 boats and 1 helicopter, cannot be monitored or supported by the Navy's exercising units.

In terms of sizes of the mitigation zones, a maximum 1,400 and 1,500 yard radius for larger charge or longer time TDFD training events are required, which is the maximum distance the Navy can confidently clear with 3 boats (or 2 boats and 1 helicopter). NMFS is satisfied that the mitigation zones proposed in the supplemental Federal Register notice for the proposed IHA (77 FR 19231; March 30, 2012) are justified, adequate, and protective of marine mammals. In addition to the buffer zone determination issue, there are also additional operational and training resources to consider. While larger mitigation zones increase distance from the detonation site, there must also be an ability to adequately survey a mitigation zone to ensure animals are spotted. Due to the type of small unit training being conducted at SSTC, there are limited surveillance assets available to monitor a given buffer zone during underwater detonations training. Scheduling additional observation boats and crews beyond what the Navy has proposed in the SSTC IHA application addendum involves coordination and availability of other unit(s) and will degrade overall training readiness. For instance, limited availability of boats and personnel do not allow for operation of 4 or more boats. If 4 boats were required, negative impacts to military readiness would result because Navy would be precluded from conducting events due to unavailable assets. Therefore, both NMFS and the Navy do not consider additional observation boats other than those designated a valid option during SSTC TDFD training events.

Comment 13: The Commission requests NMFS to advise the Navy that it should seek authorization for serious injury and incidental mortality in addition to taking by harassment. The Commission states that the March 2011 SSTC incident indicates that the Navy's monitoring and mitigation measures used to protect marine mammals during these exercises were based on faulty assumptions and were simply not adequate.

Response: Although it is true that the Navy's previous monitoring and mitigation measures were based on faulty assumptions and did not take TDFD into consideration, they have subsequently addressed the inadequacy and worked with NMFS to develop a series of more robust monitoring and mitigation measures to safeguard marine mammals from injury and mortality. The March 2011 SSTC incident is the only known mortality event ever documented from Navy underwater detonation training not only at SSTC, but also at all other areas in the Atlantic Ocean and Pacific Ocean where similar training has occurred over the past 30 years. Due to the low density and small zones of injury, the chance for injury and mortality is considered very low. In addition, the enhanced monitoring and mitigation measures discussed in Response to Comments above and in the supplemental Federal Register notice for the proposed

IHA (77 FR 19231; March 30, 2012) should prevent any injury and mortality of marine mammals by underwater detonations training.

Comment 14: One private citizen wrote against bombing.

Response: Comments noted. However, this comment is irrelevant to the proposed issuance of an IHA to the Navy to take marine mammals incidental to its training exercises.

Description of Marine Mammals in the Area of the Specified Activity

Common marine mammal species occurring regularly in the vicinity of the SSTC training area include the California sea lion (Zalophus californianus), Pacific harbor seal (Phoca vitulina richardsii), California coastal stock of bottlenose dolphin (Tursiops truncatus), and more infrequently gray whale (Eschrichtius robustus). Detailed descriptions of these species are provided in the Federal Register notice for the proposed IHA (75 FR 64276; October 19, 2010) and are not repeated here.

In addition to these four common species, an additional four dolphin species: long-beaked common dolphin, short-beaked common dolphin, Pacific white-sided dolphin, and Risso's dolphin have been sighted in the vicinity of the SSTC training area, but much less frequently. None are listed as threatened or endangered under the Endangered Species Act (ESA). Detailed descriptions of these species are provided in the supplemental Federal Register notice for the proposed IHA (77 FR 19231; March 30, 2012) and are not repeated here.

Further information on all the species can also be found in the NMFS Stock Assessment Reports (SAR). The Pacific 2011 SAR is available at: http://www.nmfs.noaa.gov/pr/pdfs/sars/po2011.pdf.

Potential Effects on Marine Mammals and Their Habitat

Anticipated impacts resulting from the Navy's proposed SSTC training activities include disturbance from underwater detonation events and pile driving from the ELCAS events, if marine mammals are in the vicinity of these action areas.

Impacts from Anthropogenic Noise

Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Kastak et al. 1999; Schlundt et al. 2000; Finneran et al. 2002; 2005). TS can be permanent (PTS), in which case the loss of hearing sensitivity is unrecoverable, or temporary (TTS), in which case the animal's hearing threshold will recover over time (Southall et al. 2007). Since marine mammals depend on acoustic cues for vital biological functions, such as orientation, communication, finding prey, and avoiding predators, marine mammals that suffer from PTS or TTS will have reduced fitness in survival and reproduction, either permanently or temporarily. Repeated noise exposure that leads to TTS could cause PTS.

Measured source levels from impact pile driving can be as high as 214 dB re 1 μPa @ 1 m. Although no marine mammals have been shown to experience TTS or PTS as a result of being exposed to pile driving activities, experiments on a bottlenose dolphin (Tursiops truncates) and beluga whale (Delphinapterus leucas) showed that exposure to a single watergun impulse at a received level of 207 kPa (or 30 psi) peak-to-peak (p-p), which is equivalent to 228 dB re 1 μPa (p-p), resulted in a 7 and 6 dB TTS in the beluga whale at 0.4 and 30 kHz, respectively. Thresholds returned to within 2 dB of the pre-exposure level within 4 minutes of the exposure (Finneran et al. 2002). No TTS was observed in the bottlenose dolphin. Although the source level of pile driving from one hammer strike is expected to be much lower than the single watergun impulse cited here, animals being exposed for a prolonged period to repeated hammer strikes could receive more noise exposure in terms of SEL than from the single watergun impulse (estimated at 188 dB re 1 μPa^2-s) in the aforementioned experiment (Finneran et al. 2002).

However, in order for marine mammals to experience TTS or PTS, the animals have to be close enough to be exposed to high intensity noise levels for a prolonged period of time. NMFS current standard mitigation for preventing injury from PTS and TTS is to require shutdown or power-down of noise sources when a cetacean species is detected within the isopleths corresponding to SPL at received levels equal to or higher than 180 dB re 1 μPa (rms), or a pinniped species at 190 dB re 1 μPa (rms). Based on the best scientific information available, these SPLs are far below the threshold that could cause TTS or the onset of PTS. Certain mitigation measures proposed by the Navy, discussed below, can effectively prevent the onset of TS in marine mammals, by establishing safety zones and monitoring safety zones during the training exercise.

In addition, chronic exposure to excessive, though not high-intensity, noise could cause masking at particular frequencies for marine mammals that utilize sound for vital biological functions. Masking could interfere with detection of acoustic signals such as communication calls, echolocation sounds, and environmental sounds important to marine mammals. Therefore, like TS, marine mammals whose acoustical sensors or environment are being masked are also impaired from maximizing their performance fitness in survival and reproduction.

Masking occurs at the frequency band which the animals utilize. Therefore, since noise generated from the proposed underwater detonation and pile driving and removal is mostly concentrated at low frequency ranges, it may have less effect on high frequency echolocation sounds by dolphin species. However, lower frequency man-made noises are more likely to affect detection of communication calls and other potentially important natural sounds such as surf and prey noise. It may also affect communication signals when they occur near the noise band used by the animals and thus reduce the communication space of animals (e.g., Clark et al. 2009) and cause increased stress levels (e.g., Foote et al. 2004; Holt et al. 2009).

Masking can potentially impact marine mammals at the individual, population, community, or even ecosystem levels (instead of individual levels caused by TS). Masking affects both senders and receivers of the signals and can potentially have long-term chronic effects on marine mammal species and populations in certain situations. Recent science suggests that low frequency ambient sound levels have increased by as much as 20 dB (more than 3 times in terms of SPL) in the world's ocean from pre-industrial periods, and most of these increases are from distant shipping (Hildebrand 2009). All anthropogenic noise sources, such as those from underwater explosions and pile driving, contribute to the elevated ambient noise levels and, thus intensify masking. However, single detonations are unlikely to contribute much to masking.

Since all of the underwater detonation events and ELCAS events are planned in a very shallow water situation (wave length >> water depth), where low frequency propagation is not efficient, the noise generated from these activities is predominantly in the low frequency range and is not expected to contribute significantly to increased ocean ambient noise.

Finally, exposure of marine mammals to certain sounds could lead to behavioral disturbance (Richardson et al. 1995). Behavioral responses to exposure to sound and explosions can range from no observable response to panic, flight and possibly more significant responses as discussed previously (Richardson et al. 1995; Southall et al. 2007). These responses include: changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities, changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping), avoidance of areas where noise sources are located, and/or flight responses (e.g., pinnipeds flushing into water from haulouts or rookeries) (Reviews by Richardson et al. 1995; Wartzok et al. 2003; Cox et al. 2006; Nowacek et al. 2007; Southall et al. 2007).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be expected to be biologically significant if the change affects growth, survival, and reproduction. Some of these significant behavioral modifications include:

- Drastic change in diving/surfacing patterns (such as those thought to be causing beaked whale stranding due to exposure to military mid-frequency tactical sonar);
- Habitat abandonment due to loss of desirable acoustic environment; and
- Cease feeding or social interaction.

For example, at the Guerreo Negro Lagoon in Baja California, Mexico, which is one of the important breeding grounds for Pacific gray whales, shipping and dredging associated with a salt works may have induced gray whales to abandon the area through most of the 1960s (Bryant et al. 1984). After these activities stopped, the lagoon was reoccupied, first by single whales and later by cow-calf pairs.

The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Southall et al. 2007).

However, the proposed action area is not believed to be a prime habitat for marine mammals, nor is it considered an area frequented by marine mammals. Therefore, behavioral disturbances that could result from anthropogenic construction noise associated with the Navy's proposed training activities are expected to affect only a small number of marine mammals on an infrequent basis.

Impacts from Underwater Detonations at Close Range

In addition to noise induced disturbances and harassment, marine mammals could be killed or injured by underwater explosions due to the impacts to air cavities, such as the lungs and bubbles in the intestines, from the shock wave (Elsayed 1997; Elsayed and Gorbunov 2007). The criterion for mortality and non-auditory injury used in MMPA take authorization is the onset of extensive lung hemorrhage and slight lung injury or ear drum rupture, respectively (see Table 3). Extensive lung hemorrhage is considered debilitating and potentially fatal as a result of air embolism or suffocation. In the Incidental Harassment Authorization application, all marine mammals within the calculated radius for 1% probability of onset of extensive lung injury (i.e., onset of mortality) were counted as lethal exposures. The range at which 1% probability of onset of extensive lung hemorrhage is expected to occur is greater than the ranges at which 50% to 100% lethality would occur from closest proximity to the charge or from presence within the bulk cavitation region. (The region of bulk cavitation is an area near the surface above the detonation point in which the reflected shock wave creates a region of cavitation within which smaller animals would not be expected to survive). Because the range for onset of extensive lung hemorrhage for smaller animals exceeds the range for bulk cavitation and all more serious injuries, all smaller animals within the region of cavitation and all animals (regardless of body mass) with more serious injuries than onset of extensive lung hemorrhage are accounted for in the lethal exposures estimate. The calculated maximum ranges for onset of extensive lung hemorrhage depend upon animal body mass, with smaller animals having the greatest potential for impact, as well as water column temperature and density.

However, due to the small detonation that would be used in the proposed SSTC training activities and the resulting small safety zones to be monitored and mitigated for marine mammals in the vicinity of the proposed action area, NMFS concluded it is unlikely that marine mammals would be killed or injured by underwater detonations.

Impact from Detonations with TDFDs

As mentioned earlier, a TDFD begins a countdown to a detonation event with a time-delaying device, and there is no mechanism to stop (abort) the pre-set explosion once the device has been set. Therefore, in the absence of any additional mitigation, the potential danger exists in the scenario that during the brief period after the exclusion zone is cleared and before the charges are detonated, marine mammals could enter the exclusion zone and approach close enough to the explosive to be injured or killed upon detonation. Nevertheless, the anticipated level of impacts to marine mammals without any mitigation and monitoring measures, which is assessed solely based on the density and distribution of the animals within the vicinity of the action, remains the same as analyzed in the original proposed IHA (75 FR 64276; October 19, 2010).

Impact Criteria and Thresholds

The effects of an at-sea explosion or pile driving on a marine mammal depends on many factors, including the size, type, and depth of both the animal and the explosive charge/pile being driven; the depth of the water column; the standoff distance between the charge/pile and the animal; and the sound propagation properties of the environment. Potential impacts can range from brief acoustic effects (such as behavioral disturbance), tactile perception, physical discomfort, slight injury of the internal organs and the auditory system, to death of the animal (Yelverton et al. 1973; O'Keeffe and Young 1984; DoN 2001). Non-lethal injury includes slight injury to internal organs and the auditory system; however, delayed lethality can be a result of individual or cumulative sub-lethal injuries (DoN 2001). Short-term or immediate lethal injury would result from massive combined trauma to internal organs as a direct result of proximity to the point of detonation or pile driving (DoN 2001).

This section summarizes the marine mammal impact criteria used for the subsequent modeled calculations. Several standard acoustic metrics (Urick 1983) are used to describe the thresholds for predicting potential physical impacts from underwater pressure waves:

- Total energy flux density or Sound Exposure Level (SEL). For plane waves (as assumed here), SEL is the time integral of the instantaneous intensity, where the instantaneous intensity is defined as the squared acoustic pressure divided by the characteristic impedance of sea water. Thus, SEL is the instantaneous pressure amplitude squared, summed over the duration of the signal and has dB units referenced to 1 re μPa^2-s.
- 1/3-octave SEL. This is the SEL in a 1/3-octave frequency band. A 1/3-octave band has upper and lower frequency limits with a ratio of 21:3, creating bandwidth limits of about 23 percent of center frequency.
- Positive impulse. This is the time integral of the initial positive pressure pulse of an explosion or explosive-like wave form. Standard units are Pa-s, but psi-ms also are used.

- Peak pressure. This is the maximum positive amplitude of a pressure wave, dependent on charge mass and range. Units used here are psi, but other units of pressure, such as μPa and Bar, also are used.

1. Harassment Threshold for Sequential Underwater Detonations

There may be rare occasions when sequential underwater detonations are part of a static location event. Sequential detonations are more than one detonation within a 24-hour period in a geographic location where harassment zones overlap. For sequential underwater detonations, accumulated energy over the entire training time is the natural extension for energy thresholds since energy accumulates with each subsequent shot.

For sequential underwater detonations, the acoustic criterion for behavioral harassment is used to account for behavioral effects significant enough to be judged as harassment, but occurring at lower sound energy levels than those that may cause TTS. The behavioral harassment threshold is based on recent guidance from NMFS (NMFS 2009a; 2009b) for the energy-based TTS threshold. The research on pure tone exposures reported in Schlundt et al. (2000) and Finneran and Schlundt (2004) provided the pure-tone threshold of 192 dB as the lowest TTS value. The resulting TTS threshold for explosives is 182 dB re 1 μPa^2-s in any 1/3 octave band. As reported by Schlundt et al. (2000) and Finneran and Schlundt (2004), instances of altered behavior in the pure tone research generally began 5 dB lower than those causing TTS. The behavioral harassment threshold is therefore derived by subtracting 5 dB from the 182 dB re 1 μPa^2-s in any 1/3 octave band threshold, resulting in a 177 dB re 1 μPa^2-s behavioral disturbance harassment threshold for multiple successive explosives (Table 3).

2. Criteria for ELCAS Pile Driving and Removal

Since 1997, NMFS has been using generic sound exposure thresholds to determine when an activity in the ocean that produces impact sound (i.e., pile driving) results in potential take of marine mammals by harassment (70 FR 1871). Current NMFS criteria (70 FR 1871) regarding exposure of marine mammals to underwater sounds is that cetaceans exposed to sound pressure levels (SPLs) of 180 dB root mean squared (dB_{rms} in units of dB re 1 µPa) or higher and pinnipeds exposed to 190 dB_{rms} or higher are considered to have been taken by Level A (i.e., injurious) harassment. Marine mammals (cetaceans and pinnipeds) exposed to impulse sounds (e.g., impact pile driving) of 160 dB_{rms} but below Level A thresholds (i.e., 180 or 190 dB) are considered to have been taken by Level B behavioral harassment. Marine mammals (cetaceans and pinnipeds) exposed to non-impulse noise (e.g., vibratory pile driving) at received levels of 120 dB RMS or above are considered to have been taken by Level B behavioral harassment (Table 1).

Table 1. Effects criteria for underwater detonations and ELCAS pile driving/removal.

<table>
<tr><th colspan="3">Underwater Explosive Criteria</th></tr>
<tr><th>Criterion</th><th>Criterion Definition</th><th>Threshold</th></tr>
<tr><td>Mortality</td><td>Onset of severe lung injury (1% probability of mortality)</td><td>30.5 psi-ms (positive impulse)</td></tr>
<tr><td rowspan="2">Level A Harassment (Injury)</td><td>Slight lung injury; or</td><td>13.0 psi-ms (positive impulse)</td></tr>
<tr><td>50% of marine mammals would experience ear drum rupture; and 30% exposed sustain PTS</td><td>205 dB re 1 µPa^2-s (full spectrum energy)</td></tr>
<tr><td rowspan="3">Level B Harassment</td><td rowspan="2">TTS (dual criteria)</td><td>23 psi (peak pressure; explosives <2,000 lbs), or</td></tr>
<tr><td>182 dB re 1 µPa^2-s (peak 1/3 octave band)</td></tr>
<tr><td>(sequential detonations only)</td><td>177 dB re 1 µPa^2-s</td></tr>
<tr><th colspan="3">Pile Driving/Removal Criteria</th></tr>
<tr><th>Criterion</th><th>Criterion Definition</th><th>Threshold</th></tr>
<tr><td rowspan="2">Level A Harassment</td><td>Pinniped only: PTS caused by repeated exposure to received levels that cause TTS</td><td>190 dB_{rms} re 1 µPa</td></tr>
<tr><td>Cetacean only: PTS caused by repeated exposure to received levels that cause TTS</td><td>180 dB_{rms} re 1 µPa</td></tr>
<tr><td>Level B Behavioral Harassment</td><td>Impulse noise: Behavioral modification of animals</td><td>160 dB_{rms} re 1 µPa</td></tr>
</table>

Underwater Explosive Criteria		
	Non-impulse noise: Behavioral modification of animals	190 dB_{rms} re 1 µPa

Assessing Harassment from Underwater Detonations

Underwater detonations produced during SSTC training events represent a single, known source. Chemical explosives create a bubble of expanding gases as the material burns. The bubble can oscillate underwater or, depending on charge-size and depth, be vented to the surface in which case there is no bubble-oscillation with its associated low-frequency energy. Explosions produce very brief, broadband pulses characterized by rapid rise-time, great zero-to-peak pressures, and intense sound, sometimes described as impulse. Close to the explosion, there is a very brief, great-pressure acoustic wave-front. The impulse's rapid onset time, in addition to great peak pressure, can cause auditory impacts, although the brevity of the impulse can include less SEL than expected to cause impacts. The transient impulse gradually decays in magnitude as it broadens in duration with range from the source. The waveform transforms to approximate a low-frequency, broadband signal with a continuous sound energy distribution across the spectrum. In addition, underwater explosions are relatively brief, transitory events when compared to the existing ambient noise within the San Diego Bay and at the SSTC.

The impacts of an underwater explosion to a marine mammal are dependent upon multiple factors including the size, type, and depth of both the animal and the explosive. Depth of the water column and the distance from the charge to the animal also are determining factors as are boundary conditions that influence reflections and refraction of energy radiated from the source. The severity of physiological effects generally decreases with decreasing exposure (impulse, sound exposure level, or peak pressure) and/or increasing distance from the sound source. The same generalization is not applicable for behavioral effects, because they do not depend solely on sound exposure level. Potential impacts can range from brief acoustic effects, tactile perception, and physical discomfort to both lethal and non-lethal injuries. Disturbance of ongoing behaviors could occur as a result of non-injurious physiological responses to both the acoustic signature and shock wave from the underwater explosion. Non-lethal injury includes slight injury to internal organs and auditory system. The severity of physiological effects generally decreases with decreasing sound exposure and/or increasing distance from the sound source. Injuries to internal organs and the auditory system from shock waves and intense impulsive noise associated with explosions can be exacerbated by strong bottom-reflected pressure pulses in reverberant environments (Gaspin 1983; Ahroon et al. 1996). Nevertheless, the overall size of the explosives used at the SSTC is much smaller than those used during larger Fleet ship and aircraft training events.

All underwater detonations proposed for SSTC were modeled as if they will be conducted in shallow water of 24 to 72 feet, including those that would normally be conducted in very shallow water (VSW) depths of zero to 24 feet. Modeling in deeper than actual water depths causes the modeled results to be more conservative (i.e., it overestimates propagation and potential exposures) than if the underwater detonations were modeled at their actual, representative depths when water depth is less than 24 feet.

The Navy's underwater explosive effects simulation requires six major process components:

- a training event description including explosive type;
- physical oceanographic and geoacoustic data for input into the acoustic propagation model representing seasonality of the planned operation;

- biological data for the area including density (and multidimensional animal movement for those training events with multiple detonations);
- an acoustic propagation model suitable for the source type to predict impulse, energy, and peak pressure at ranges and depths from the source;
- the ability to collect acoustic and animal movement information to predict exposures for all animals during a training event (dosimeter record); and
- the ability for post-operation processing to evaluate the dosimeter exposure record and calculate exposure statistics for each species based on applicable thresholds.

An impact model, such as the one used for the SSTC analysis, simulates the conditions present based on location(s), source(s), and species parameters by using combinations of embedded models (Mitchell et al. 2008). The software package used for SSTC consists of two main parts: an underwater noise model and bioacoustic impact model (Lazauski et al. 1999; Lazauski and Mitchell 2006; Lazauski and Mitchell 2008).

Location-specific data characterize the physical and biological environments while exercise-specific data construct the training operations. The quantification process involves employment of modeling tools that yield numbers of exposures for each training operation.

During modeling, the exposures are logged in a time-step manner by virtual dosimeters linked to each simulated animal. After the operation simulation, the logs are compared to exposure thresholds to produce raw exposure statistics. It is important to note that dosimeters only were used to determine exposures based on energy thresholds, not impulse or peak pressure thresholds. The analysis process uses quantitative methods and identifies immediate short-term impacts of the explosions based on assumptions inherent in modeling processes, criteria and thresholds used, and input data. The estimations should be viewed with caution, keeping in mind that they do not reflect measures taken to avoid these impacts (i.e., mitigations). Ultimately, the goals of this acoustic impact model were to predict acoustic propagation, estimate exposure levels, and reliably predict impacts.

Predictive sound analysis software incorporates specific bathymetric and oceanographic data to create accurate sound field models for each source type. Oceanographic data such as the sound speed profiles, bathymetry, and seafloor properties directly affect the acoustic propagation model. Depending on location, seasonal variations, and the oceanic current flow, dynamic oceanographic attributes (e.g., sound speed profile) can change dramatically with time. The sound field model is embedded in the impact model as a core feature used to analyze sound and pressure fields associated with SSTC underwater detonations.

The sound field model for SSTC detonations was the Reflection and Refraction in Multilayered Ocean/Ocean Bottoms with Shear Wave Effects (REFMS) model (version 6.03). The REFMS model calculates the combined reflected and refracted shock wave environment for underwater detonations using a single, generalized model based on linear wave propagation theory (Cagniard 1962; Britt 1986; Britt et al. 1991).

The model outputs include positive impulse, sound exposure level (total and in 1/3-octave bands) at specific ranges and depths of receivers (i.e., marine mammals), and peak pressure. The shock wave consists of two parts, a very rapid onset “impulsive” rise to positive peak over-pressure followed by a reflected negative under-pressure rarefaction wave. Propagation of shock waves and sound energy in the shallow-water environment is constrained by boundary conditions at the surface and seafloor.

Multiple locations (in Boat Lanes and Echo area) and charge depths were used to determine the most realistic spatial and temporal distribution of detonation types associated with each training operation for a representative year. Additionally, the effect of sound on an animal depends on many factors including:

- properties of the acoustic source(s): source level (SL), spectrum, duration, and duty cycle;
- sound propagation loss from source to animal, as well as, reflection and refraction;
- received sound exposure measured using well-defined metrics;
- specific hearing;
- exposure duration; and
- masking effects of background and ambient noise.

To estimate exposures sufficient to be considered injury or significantly disrupt behavior by affecting the ability of an individual animal to grow (e.g., feeding and energetics), survive (e.g., behavioral reactions leading to injury or death, such as stranding), reproduce (e.g., mating behaviors), and/or degrade habitat quality resulting in abandonment or avoidance of those areas, dosimeters were attached to the virtual animals during the simulation process. Propagation and received impulse, SEL, and peak pressure are a function of depth, as well as range, depending on the location of an animal in the simulation space.

A detailed discussion of the computational process for the modeling, which ultimately generates two outcomes – the zones of influence (ZOIs) and marine mammal exposures, is presented in the Navy's IHA application.

Severity of an effect often is related to the distance between the sound source and a marine mammal and is influenced by source characteristics (Richardson and Malme 1995). For SSTC, ZOIs were estimated for the different charge weights, charge depths, water depths, and seasons using the REFMS model as described previously. These ZOIs for SSTC underwater detonations by training event are shown in Table 2, which was updated from Table 4 in the Federal Register notice (75 FR 64276; October 19, 2010) for the proposed IHA. This change is merely a correction of erroneous table values. The Navy impact modeling used the correct propagation ZOIs and effects in their marine mammal exposure estimates, so the table change does not change any effects analysis presented in the Federal Register notice (75 FR 64276; October 19, 2010) for the proposed IHA. One correction is changing the 23 psi table entry (for the Marine Mammal systems 29-lb NEW event) to 490 yards. Since the proposed mitigation zone is based on the maximum ZOI under the dual TTS criteria, this revision changed from the previous maximum of 470 yards to 490 yards, an addition of 20 yards. In addition, Table 2 added a column that shows the ZOIs for sub-TTS behavioral harassment.

For single detonations, the ZOIs were calculated using the range associated with the onset of TTS based on the Navy REFMS model predictions.

Table 2. Maximum ZOIs for Underwater Detonation Events at SSTC.

Activity #, Underwater Detonation Activity, NEW Charge Weight Used, And Annual Activity Amount	Season*	Maximum ZOI (yards)					
		Sub-TTS	TTS		Injury		Mortality
		177 dB re 1μPa^2-sec	23 psi	182 dB re 1μPa^2-sec	13.0 psi-msec	205 dB re 1μPa^2-sec	30.5 psi-msec
Shock wave action generator (SWAG) (San Diego Bay- Echo sub-area; 0.033 NEW (74/yr)	Warm	n/a	60	20	0	0	0
	Cold	n/a	40	20	0	0	0
SWAG (SSTC-North and South Oceanside; 0.033 NEW (16/yr)	Warm	n/a	60	20	0	0	0
	Cold	n/a	40	20	0	0	0
Mine Countermeasures (20 lbs NEW; 29/yr)	Warm	n/a	470	300	360	80	80
	Cold	n/a	450	340	160	80	80
Floating Mine (5 lbs NEW; 53/yr)	Warm	n/a	240	160	80	40	20
	Cold	n/a	260	180	80	40	20
Dive Platoon (3.5 lb NEW sequential; 8/yr)	Warm	470	210	330	80	90	50
	Cold	560	220	370	90	90	50
Unmanned Underwater Vehicle (15 lb NEW; 4/yr)	Warm	n/a	440	280	360	80	80
	Cold	n/a	400	320	150	80	80
Marine Mammal Systems (29 lb NEW sequential; 8/yr)	Warm	740	380	420	360	140	90
	Cold	650	450	470	170	140	90
Marine Mammal Systems (29 lb NEW; 8/yr)	Warm	n/a	400	330	360	100	90
	Cold	n/a	490**	370	170	100	90
Mine Neutral (3.5 lb NEW sequential; 4/yr)	Warm	470	330	330	80	90	50
	Cold	560	360	370	90	90	50
Surf Zone Training and Evaluation (<20 lb NEW; 2/yr)	Warm	n/a	470	300	160	80	80
	Cold	n/a	450	340	160	80	80
UUV Neutral (3.6 lb NEW sequential; 4/yr)	Warm	260	400	280	80	60	50
	Cold	280	400	320	90	60	50
AMNS (3.5 lb NEW; 10/yr)	Warm	n/a	220	170	80	40	40
	Cold	n/a	230	180	80	40	40
Qual/Cert (13.8 lb NEW sequential; 8/yr)	Warm	n/a	470	330	140	100	80
	Cold	n/a	330	370	140	100	80
Qual/Cert (25.5 lb NEW; 4/yr)	Warm	470	430	330	300	90	90
	Cold	530	470	360	170	90	90
Naval Special Warfare Demolition Training (10 lb NEW; 4/yr)	Warm	n/a	360	240	160	80	40
	Cold	n/a	360	250	160	80	40
Naval Special Warfare Demolition Training (3.6 lb NEW; 4/yr)	Warm	n/a	400	280	80	60	50
	Cold	n/a	400	320	90	60	50
Naval Special Warfare SEAL Delivery Vehicle (10 lb NEW; 40/yr)	Warm	n/a	360	240	160	80	40
	Cold	n/a	360	250	160	80	40
Naval Special Warfare SEAL Delivery Vehicle (10 lb NEW; 40/yr)	Warm	n/a	360	240	160	80	40
	Cold	n/a	360	250	160	80	40

* Warm: November – April; cold: May – October.
** Although revising maximum ZOI to 490 yards from 400 yards, with only 8 detonations per year, this Maximum ZOI of 490 yards would only likely occur < 1.3% (4/311) of all annual SSTC underwater detonations.

For Multiple Successive Explosive events (i.e., sequential detonations), the ZOI calculation was based on the range to non-TTS behavior disruption. Calculating the zones of influence in terms of total SEL, 1/3-octave bands SEL, impulse, and peak pressure for sequential (10 sec timed) and multiple controlled detonations (> 30 minutes) was slightly different than for the single detonations. For the sequential detonations, ZOI calculations considered spatial and temporal distribution of the detonations, as well as the effective accumulation of the resultant acoustic energy. To calculate the ZOI, sequential detonations were modeled such that explosion SEL were summed incoherently to predict zones while peak pressure was not.

In summary, all ZOI radii were strongly influenced by charge size and placement in the water column, and only slightly by the environmental variables.

Very Shallow Water (VSW) Underwater Detonations Live-Fire Tests ZOI Determination

Measurements of the propagated pressures during single-charge underwater detonation exercises in VSW at SSTC (and San Clemente Island) were conducted in 2002 as part of a study to evaluate existing underwater explosive propagation models for application to VSW conditions (unpublished, Naval Special Warfare Center/Anteon Corporation 2005, cited in the Navy's SSTC IHA Application). The direct measurements made in those tests provided an in-place characterization of pressure propagation for the training exercises as they are actually conducted at the SSTC. During the tests, 2 and 15 lbs charges of NEW explosives were detonated in 6 and 15 feet of water with charges laying on the bottom or two feet off the bottom at SSTC and San Clemente Island. At SSTC, swell conditions precluded detonations at the 6-foot depth. Peak-pressures (unfiltered) and energies – between 100 Hz and 41 kHz - in 1/3-octave bands of highest energies from each detonation were measured in three locations relative to the charges: 1) 5 - 10 feet seaward of the charge, 2) 280 - 540 feet seaward, and 3) at about 1,000 feet seaward. Underwater detonations of small 2 lb charges at SSTC were measured at a "near range" location within feet of the charge and at a "single far range" of 525 feet from the charge (unpublished, Naval Special Warfare Center/Anteon Corporation 2005, cited in the Navy's SSTC IHA Application 2010). In the tests, the position of single charges - on and 2 feet off the bottom – affected the propagated peak-pressures. Off-bottom charges produced consistently greater peak-pressures than on-bottom charges as measured at about 200, 500, and 1,000 feet distances. Off-bottom 15 lb charges in 15 feet of water produced between 43 – 67 % greater peak-pressures than on-bottom charges. Greater differences were found when detonations occurred in extremely shallow depths of 6 feet at San Clemente Island (unpublished, Naval Special Warfare Center/Anteon Corporation 2005, cited in the Navy's SSTC IHA Application 2010). Generally, measurements during single-charge exercises produced empirical data that were predicted by the propagation models. At about 1,000 feet seaward, peak-pressure varied from 11 - 17 pounds psi at different depths, and energies between 100 Hz and 41 kHz in the 1/3-octave bands of highest energies varied from about 175 - 186 dB re 1 μPa^2-s at different depths. From the measurements, it was determined that the range at which the criterion for onset-TTS would be expected to occur in small odontocetes matched the range predicted by a conservative model of propagation that assumed a boundary-less medium and equal sound velocity at all depths in the range – i.e., an "iso-velocity" model. Bottom and water-column conditions also influence pressure-wave propagation and dissipation of blast residues.

In comparison, predictions made by the Navy's REFMS model (see above) were found to be unstable across the distances considered under the conditions of VSW with bottom or near bottom charge placement, reflective bottom, and a non-refractive water column (i.e., equal sound velocity at all depths). The source of instability in the REFMS predictions is most likely due to the nature of the VSW zone wherein the ratio of depth to range is very small – a known problem for the REFMS' predictive ray-tracing. Therefore, the determination of ZOIs within the VSW zones was based on the empirical propagation data and iso-velocity model predictions discussed above for charge-weights of 20 lbs or less of NEW explosive on the bottom and for charge-weights of 3.6 lbs or less off the bottom. For SSTC this range was determined to be a 1,200-foot (400-yard) radius out from the site of the detonation with the shoreward half of the implied circle being truncated by the shoreline and extremely shallow water immediately off shore.

Assessing ELCAS Pile Driving and Removal Impacts

Noise associated with ELCAS training includes loud impulsive sounds derived from driving piles into the soft sandy substrate of the SSTC waters to temporarily support a causeway of linked pontoons. Two hammer-based methods will be used to install/remove ELCAS piles: impact pile driving for installation and vibratory driving for removal. The impact hammer is a large metal ram attached to a crane. A vertical support holds the pile in place and the ram is dropped or forced downward. The energy is then transferred to the pile which is driven into the seabed. The ram is typically lifted by a diesel power source.

The methodology for analyzing potential impacts from ELCAS events is similar to that of analyzing explosives. The ELCAS analysis includes two steps used to calculate potential exposures:

- Estimate the zone of influence for Level A injurious and Level B behavioral exposures for both impact pile driving and vibratory pile removal using the practical spreading loss equation (CALTRANS 2009).
- Estimate the number of species exposed using species density estimates and estimated zones of influence.

The practical spreading loss equation is typically used to estimate the attenuation of underwater sound over distance. The formula for this propagation loss can be expressed as:

TL = F * log (D1/D2)

Where:

TL = transmission loss (the sound pressure level at distance D1 minus the sound pressure level at distance D2 from the source, in dB_{rms} re 1µPa)

F = attenuation constant

D1 = distance at which the targeted transmission loss occurs

D2 = distance from which the transmission loss is calculated

The attenuation constant (F) is a site-specific factor based on several conditions, including water depth, pile type, pile length, substrate type, and other factors. Measurements conducted by the California Department of Transportation (CADOT) and other consultants (Greeneridge Science) indicate that the attenuation constant (F) can vary from 5 to 30. Small-diameter steel H-type piles have been found to have high F values in the range of 20 to 30 near the pile (i.e., between 30 - 60 feet) (CALTRANS 2009). In the absence of empirically measured values at SSTC, NMFS and the Navy worked to set the F value for SSTC to be on the low (conservative, and more predictive) end of the small-diameter steel piles at F = 15, to indicate that the spreading loss is between the spherical (F = 20) and cylindrical (F = 10).

Actual noise source levels of ELCAS pile driving at SSTC depend on the type of hammer used, the size and material of the pile, and the substrate the piles are being driven into. Using known equipment, installation procedures, and applying certain constants derived from other west coast measured pile driving, predicted underwater sound levels from ELCAS pile driving can be calculated. The ELCAS uses 24-inch diameter hollow steel piles, installed using a diesel impact hammer to drive the piles into the sandy on-shore and near-shore substrate at SSTC. For a dock repair project in Rodeo, California in San Francisco Bay, underwater sound pressure level (SPL) for a 24-inch steel pipe pile driven with a diesel impact hammer in less than 15 ft of water depth was measured at 189 dB_{rms} re 1uPa from approximately 33 ft (11 yards) away. SPL for the same type and size pile also driven with a diesel impact hammer, but in greater than 36 ft of water depth, was measured to be 190 to 194 dB_{rms} during the Amoco Wharf repair project in Carquinez Straits, Martinez, California (CADOT 2009). The areas where these projects were conducted have a silty sand bottom with an underlying hard clay layer, which because of the extra effort required to drive into clay, would make these measured pile driving sound levels louder (more conservative) than they would if driving into SSTC's sandy substrate. Given the local bathymetry and smooth sloping sandy bottom at SSTC, ELCAS piles will generally be driven in water depths of 36 ft or less.

Therefore, for the purposes of the Navy's SSTC ELCAS analysis, both the Rodeo repair project (189 dB_{rms}) and the low end of the measured values of the Amoco Wharf repair projects (190 dB_{rms}) are considered to be reasonably representative of sound levels that would be expected during ELCAS pile driving at SSTC. For hollow steel piles of similar size as those proposed for the ELCAS (<24-in diameter) used in Washington State and California pile driving projects, the broadband frequency range of underwater sound was measured between 50 Hz to 10.5 kHz with highest energy at frequencies <1 to 3 kHz (CALTRANS 2009). Although frequencies over 10.5 kHz are likely present during these pile driving projects, they are generally not typically measured since field data has shown a decrease in SPL to less than 120 dB at frequencies greater than 10.5 kHz (Laughlin 2005; 2007). It is anticipated that ELCAS pile driving would generate a similar sound spectra.

For ELCAS training events, using an estimated SPL measurement of 190 dB_{rms} re 1 μPa at 11 yards as describe above, the circular ZOIs surrounding a 24-inch steel diesel-driven ELCAS pile can be estimated via the practical spreading loss equation to have radii of:

- 11 yards for Level A injurious harassment for pinnipeds (190 dB_{rms});
- 46 yards for Level A injurious harassment for cetaceans (180 dB_{rms}), and
- 1,094 yards for the Level B behavioral harassment (160 dB_{rms}).

It should be noted that ELCAS pier construction starts with piles being driven near the shore and extends offshore. Near the shore, the area of influence would be a semi-circle and towards the end of the ELCAS (approximately 1,200 feet or 400 yards from the shore) would be a full circle. The above calculated area of influence conservatively assumes that all ELCAS piles are driven offshore at SSTC, producing a circular zone of influence, and discounts the limited propagation from piles driven closer to shore.

Noise levels derived from piles removed via vibratory extractor are different than those driven with an impact hammer. Steel pilings and a vibratory driver were used for pile driving at the Port of Oakland (CALTRANS 2009). Underwater SPLs during this project for a 24-inch steel pile in 36 ft of water depth at a distance of 11 yards (33 feet) from the source was field measured to be 160 dB_{rms}. The area where this project was conducted (Oakland) has a harder substrate, which because of the extra effort required to drive and remove the pile, would make these measured pile driving sound levels louder (more conservative) than they would if driving and removing into and from SSTC's sandy substrate. Conservatively using this SPL measurement for SSTC and F = 15, the ZOIs for a 24-inch steel pile removed via a vibratory extractor out to different received SPLs can be estimated via the practical spreading loss equation to be:

- < 1 yard for Level A injurious harassment for pinnipeds (190 dB_{rms});
- One (1) yard for Level A injurious harassment for cetaceans (180 dB_{rms}), and
- 5,076 yards for Level B behavioral harassment (120 dB_{rms}).

As discussed above, the calculated area of influence conservatively assumes that all ELCAS piles are driven and subsequently removed offshore at SSTC, producing a circular zone of influence.

Mitigation Measures

In order to issue an incidental take authorization under Section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses.

For the Navy's proposed SSTC training activities, NMFS worked with the Navy and developed the following mitigation measures to minimize the potential impacts to marine mammals in the project vicinity as a result of the underwater detonations (including detonations with TDFDs) and ELCAS pile driving/removal events.

Mitigation Measures for Underwater Detonations

(A) Mitigation and Monitoring Measures for Underwater Detonations in Very Shallow Water (VSW, water depth < 24 ft)

(1) Mitigation and Monitoring Measures for VSW Underwater Detonations Using Positive Control

1. Underwater detonations using positive control (remote firing devices) will only be conducted during daylight.

2. Easily visible anchored floats will be positioned on 700 yard radius of a roughly semi-circular zone (the shoreward half being bounded by shoreline and immediate off-shore water) around the detonation location for small explosive exercises at the SSTC. These mark the outer limits of the mitigation zone.

3. For each VSW underwater detonation event, a safety-boat with a minimum of one observer is launched 30 or more minutes prior to detonation and moves through the area around the detonation site. The task of the safety observer is to exclude humans from coming into the area and to augment a shore observer's visual search of the mitigation zone for marine mammals. The safety-boat observer is in constant radio communication with the exercise coordinator and shore observer discussed below.

4. A shore-based observer will also be deployed for VSW detonations in addition to boat based observers. The shore observer will indicate that the area is clear of marine mammals after 10 or more minutes of continuous observation with no marine mammals having been seen in the mitigation zone or moving toward it.

5. At least 10 minutes prior to the planned initiation of the detonation event-sequence, the shore observer, on an elevated on-shore position, begins a continuous visual search with binoculars of the mitigation zone. At this time, the safety-boat observer informs the shore observer if any marine mammal has been seen in the zone and, together, both search the surface within and beyond the mitigation zone for marine mammals.

6. The observers (boat and shore based) will indicate that the area is not clear any time a marine mammal is sighted in the mitigation zone or moving toward it and, subsequently, indicate that the area is clear of marine mammals when the animal is out and moving away and no other marine mammals have been sited.

7. Initiation of the detonation sequence will only begin on final receipt of an indication from the shore observer that the area is clear of marine mammals and will be postponed on receipt of an indication from any observer that the area is not clear of marine mammals.

8. Following the detonation, visual monitoring of the mitigation zone continues for 30 minutes for the appearance of any marine mammal in the zone. Any marine mammal appearing in the area will be observed for signs of possible injury.

9. Any marine mammal observed after a VSW underwater detonation either injured or exhibiting signs of distress will be reported via operational chain of command to Navy environmental representatives from U.S. Pacific Fleet, Environmental Office, San Diego Detachment. Using Marine Mammal Stranding communication trees and contact procedures established for the Southern California Range Complex, the Navy will report these events to the Stranding Coordinator of NMFS' Southwest Regional Office. These voice or email reports will contain the date and time of the sighting, location (or if precise latitude and longitude is not currently available, then the approximate location in reference to an established SSTC beach feature), species description (if known), and indication of the animal's status.

(2) <u>Mitigation and Monitoring Measures for VSW Underwater Detonations Using Time-Delay (TDFD Only)</u>

1. Underwater detonations using timed delay devices will only be conducted during daylight.

2. Time-delays longer than 10 minutes will not be used. The initiation of the device will not start until the mitigation area below is clear for a full 30 minutes prior to initiation of the timer.

3. A mitigation zone will be established around each underwater detonation location as indicated in Table 3 (1,000 or 1,400 yards) based on charge weight and length of time delay used.

Table 3. Updated Buffer Zone Radius (yd) for TDFDs Based on Size of Charge and Length of Time-Delay, with Additional Buffer Added to Account for Faster Swim Speeds

		Time-delay					
		5 min	6 min	7min	8 min	9 min	10 min
Charge Size (lb NEW)	5 lb	1,000 yd	1,000 yd	1,000 yd	1,000 yd	1,400 yd	1,400 yd
	10 lb	1,000 yd	1,000 yd	1,000 yd	1,400 yd	1,400 yd	1,400 yd
	15-29 lb	1,000 yd	1,400 yd	1,400 yd	1,400 yd	1,500 yd	1,500 yd

4. VSW ranges 1,000 yds:

- For each VSW underwater detonation event with a mitigation zone of 1,000 yds, a safety boat with a minimum of one observer is launched 30 or more minutes prior to detonation and moves through the area around the detonation site at the seaward edge of the mitigation zone. The task of the boat is to exclude humans from coming into the area and to augment a shore observer's visual search of the mitigation zone for marine mammals. The safety-boat observer is in constant radio communication with the exercise coordinator and shore observer discussed below. To the best extent practical, boats will try to maintain a 10 knot search speed.

- A shore-based observer will also be deployed for VSW detonations in addition to boat based observers. At least 10 minutes prior to the planned initiation of the detonation event-sequence, the shore observer, on an elevated on-shore position, begins a continuous visual search with binoculars of the mitigation zone. At this time, the safety-boat observer informs the shore observer if any marine mammal has been seen in the zone and, together, both search the surface within and beyond the mitigation zone for marine mammals. The shore observer will indicate that the area is clear of marine mammals after 10 or more minutes of continuous observation with no marine mammals having been seen in the mitigation zone or moving toward it.

5. VSW ranges larger than 1,400 yards:

- A minimum of 2 boats will be used to survey for marine mammals at mitigation ranges larger than 1,400 yards.
- When conducting the surveys within a mitigation zone >1,400 yds, boats will position themselves near the mid-point of the mitigation zone radius (but always outside the detonation plume radius/human safety zone) and travel in a semi-circular pattern around the detonation location surveying both the inner (toward detonation site) and outer (away from detonation site) areas. When using 2 boats, each boat will be positioned on opposite sides of the detonation location, separated by 180 degrees. If using more than 2 boats, each boat will be positioned equidistant from one another (120 degrees separation for 3 boats, 90 degrees separation for 4 boats, etc.). If available, aerial visual survey support

from Navy helicopters can be utilized, so long as it will not jeopardize safety of flight. Helicopters will travel in a circular pattern around the detonation location.

6. A mitigation zone will be surveyed from 30 minutes prior to the detonation and for 30 minutes after the detonation.

7. Other personnel besides boat observers can also maintain situational awareness on the presence of marine mammals within the mitigation zone to the best extent practical given dive safety considerations.

Divers placing the charges on mines will observe the immediate underwater area around a detonation site for marine mammals and report sightings to surface observers.

8. If a marine mammal is sighted within an established mitigation zone or moving towards it, underwater detonation events will be suspended until the marine mammal has voluntarily left the area and the area is clear of marine mammals for at least 30 minutes.

9. Immediately following the detonation, visual monitoring for affected marine mammals within the mitigation zone will continue for 30 minutes.

10. Any marine mammal observed after an underwater detonation either injured or exhibiting signs of distress will be reported via Navy operational chain of command to Navy environmental representatives from U.S. Pacific Fleet, Environmental Office, San Diego Detachment. Using Marine Mammal Stranding communication trees and contact procedures established for the Southern California Range Complex, the Navy will report these events to the Stranding Coordinator of NMFS' Southwest Regional Office. These voice or email reports will contain the date and time of the sighting, location (or if precise latitude and longitude is not currently available, then the approximate location in

reference to an established SSTC beach feature), species description (if known), and indication of the animal's status.

(B) Mitigation and Monitoring Measures for Underwater Detonations in Shallow Water (>24 Feet)

(1) Mitigation and Monitoring Measures for Underwater Detonations Using Positive Control (Except SWAG and Timed Detonations)

1. Underwater detonations using positive control devices will only be conducted during daylight.

2. A mitigation zone of 700 yards will be established around each underwater detonation point.

3. A minimum of two boats, including but not limited to small zodiacs and 7-m Rigid Hulled Inflatable Boats (RHIB) will be deployed. One boat will act as an observer platform, while the other boat is typically the diver support boat.

4. Two observers with binoculars on one small craft/boat will survey the detonation area and the mitigation zone for marine mammals from at least 30 minutes prior to commencement of the scheduled explosive event and until at least 30 minutes after detonation.

5. In addition to the dedicated observers, all divers and boat operators engaged in detonation events can potentially monitor the area immediately surrounding the point of detonation for marine mammals.

6. If a marine mammal is sighted within the 700 yard mitigation zone or moving towards it, underwater detonation events will be suspended until the marine mammal has voluntarily left the area and the area is clear of marine mammals for at least 30 minutes.

7. Immediately following the detonation, visual monitoring for marine mammals within the mitigation zone will continue for 30 minutes. Any marine mammal observed after an underwater detonation either injured or exhibiting signs of distress will be reported to via Navy operational chain of command to Navy environmental representatives from U.S. Pacific Fleet, Environmental Office, San Diego Detachment. Using Marine Mammal Stranding communication trees and contact procedures established for the Southern California Range Complex, the Navy will report these events to the Stranding Coordinator of NMFS' Southwest Regional Office. These voice or email reports will contain the date and time of the sighting, location (or if precise latitude and longitude is not currently available, then the approximate location in reference to an established SSTC beach feature), species description (if known), and indication of the animals status.

(2) Mitigation and Monitoring Measures for Underwater Detonations Using Time-Delay (TDFD Detonations Only)

1. Underwater detonations using timed delay devices will only be conducted during daylight.

2. Time-delays longer than 10 minutes will not be used. The initiation of the device will not start until the mitigation area below is clear for a full 30 minutes prior to initiation of the timer.

3. A mitigation zone will be established around each underwater detonation location as indicated in Table 3 based on charge weight and length of time-delay used. When conducting the surveys within a mitigation zone (either 1,000 or 1,400 yds), boats will position themselves near the mid-point of the mitigation zone radius (but always outside

the detonation plume radius/human safety zone) and travel in a circular pattern around the detonation location surveying both the inner (toward detonation site) and outer (away from detonation site) areas.

4. Shallow water TDFD detonations range 1,000 yds:

- A minimum of 2 boats will be used to survey for marine mammals at mitigation ranges of 1,000 yds.
- When using 2 boats, each boat will be positioned on opposite sides of the detonation location, separated by 180 degrees.
- Two observers in each of the boats will conduct continuous visual survey of the mitigation zone for the entire duration of a training event.
- To the best extent practical, boats will try to maintain a 10 knot search speed. This search speed was added to ensure adequate coverage of the buffer zone during observation periods. While weather conditions and sea states may require slower speeds in some instances, 10 knots is a prudent, safe, and executable speed that will allow for adequate surveillance. For a 1,000 yd radius buffer zone a boat travelling at 10 knots and 500 yds away from the detonation point would circle the detonation point 3.22 times during a 30 minute survey period. By using 2 boats, 6.44 circles around the detonation point would be completed in a 30 minute span.

5. Shallow water TDFD detonations greater than 1,400 yds:

- A minimum of 3 boats or 2 boats and 1 helicopter will be used to survey for marine mammals at mitigation ranges of 1,400 yds.

- When using 3 (or more) boats, each boat will be positioned equidistant from one another (120 degrees separation for 3 boats, 90 degrees separation for 4 boats, etc.).
- For a 1,400 yd radius mitigation zone, a 10 knot speed results in 2.3 circles for each of the three boats, or nearly 7 circles around the detonation point over a 30 minute span.
- If available, aerial visual survey support from Navy helicopters can be utilized, so long as it will not jeopardize safety of flight.
- Helicopters, if available, can be used in lieu of one of the boat requirements. Navy helicopter pilots are trained to conduct searches for relatively small objects in the water, such as a missing person. A helicopter search pattern is dictated by standard Navy protocols and accounts for multiple variables, such as the size and shape of the search area, size of the object being searched for, and local environmental conditions, among others.

6. A mitigation zone will be surveyed from 30 minutes prior to the detonation and for 30 minutes after the detonation.

7. Other personnel besides boat observers can also maintain situational awareness on the presence of marine mammals within the mitigation zone to the best extent practical given dive safety considerations.

Divers placing the charges on mines will observe the immediate underwater area around a detonation site for marine mammals and report sightings to surface observers.

8. If a marine mammal is sighted within an established mitigation zone or moving towards it, underwater detonation events will be suspended until the marine mammal has

voluntarily left the area and the area is clear of marine mammals for at least 30 minutes.

9. Immediately following the detonation, visual monitoring for affected marine mammals within the mitigation zone will continue for 30 minutes.

10. Any marine mammal observed after an underwater detonation either injured or exhibiting signs of distress will be reported via Navy operational chain of command to Navy environmental representatives from U.S. Pacific Fleet, Environmental Office, San Diego Detachment or Pearl Harbor. Using Marine Mammal Stranding protocols and communication trees established for the Southern California and Hawaii Range Complexes, the Navy will report these events to the Stranding Coordinator of NMFS' Southwest or Pacific Islands Regional Office. These voice or email reports will contain the date and time of the sighting, location (or if precise latitude and longitude is not currently available, then the approximate location in reference to an established SSTC beach feature), species description (if known), and indication of the animal's status.

<u>(3) Mitigation and Monitoring Measures for Underwater SWAG Detonations (SWAG Only)</u>

A modified set of mitigation measures would be implemented for SWAG detonations, which involve much smaller charges of 0.03 lbs NEW.

1. Underwater detonations using SWAG will only be conducted during daylight.

2. A mitigation zone of 60 yards will be established around each SWAG detonation site.

3. A minimum of two boats, including but not limited to small zodiacs and 7-m Rigid Hulled Inflatable Boats (RHIB) will be deployed. One boat will act as an observer platform, while the other boat is typically the diver support boat.

4. Two observers with binoculars on one small craft\boat will survey the detonation area and the mitigation zone for marine mammals from at least 10 minutes prior to commencement of the scheduled explosive event and until at least 10 minutes after detonation.

5. In addition to the dedicated observers, all divers and boat operators engaged in detonation events can potentially monitor the area immediately surrounding the point of detonation for marine mammals.

6. Divers and personnel in support boats would monitor for marine mammals out to the 60 yard mitigation zone for 10 minutes prior to any detonation.

7. After the detonation, visual monitoring for marine mammals would continue for 10 minutes. Any marine mammal observed after an underwater detonation either injured or exhibiting signs of distress will be reported via Navy operational chain of command to Navy environmental representatives from U.S. Pacific Fleet, Environmental Office, San Diego Detachment. Using Marine Mammal Stranding communication trees and contact procedures established for the Southern California Range Complex, the Navy will report these events to the Stranding Coordinator of NMFS' Southwest Regional Office. These voice or email reports will contain the date and time of the sighting, location (or if precise latitude and longitude is not currently available, then the approximate location in reference to an established SSTC beach feature), species description (if known), and indication of the animal's status.

<u>Mitigation for ELCAS Training at SSTC</u>

NMFS worked with the Navy and developed the below mitigation procedures for ELCAS pile driving and removal events along the oceanside Boat Lanes at the SSTC for marine mammal species.

1. Safety Zone: A safety zone shall be established at 150 feet (50 yards) from ELCAS pile driving or removal events. This safety zone is base on the predicted range to Level A harassment (180 dB_{rms}) for cetaceans during pile driving, and is being applied conservatively to both cetaceans and pinnipeds during pile driving and removal.

2. If marine mammals are found within the 150-foot (50-yard) safety zone, pile driving or removal events shall be halted until the marine mammals have voluntarily left the mitigation zone.

3. Monitoring for marine mammals shall be conducted within the zone of influence and take place at 30 minutes before, during, and 30 minutes after pile driving and removal activities, including ramp-up periods. A minimum of one trained observer shall be placed on shore, on the ELCAS, or in a boat at the best vantage point(s) practicable to monitor for marine mammals.

4. Monitoring observer(s) shall implement shut-down/delay procedures by calling for shut-down to the hammer operator when marine mammals are sighted within the safety zone. After a shut-down/delay, pile driving or removal shall not be resumed until the marine mammal within the safety zone is confirmed to have left the area or 30 minutes have passed without seeing the animal.

5. Soft Start - ELCAS pile driving shall implement a soft start as part of normal construction procedures. The pile driver increases impact strength as resistance goes up. At first, the pile driver piston drops a few inches. As resistance goes up, the pile driver

piston will drop from a higher distance thus providing more impact due to gravity. This will allow marine mammals in the project area to vacate or begin vacating the area minimizing potential harassment.

NMFS has carefully evaluated these proposed mitigation measures. Our evaluation of potential measures included consideration of the following factors in relation to one another:

- the manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals,
- the proven or likely efficacy of the specific measure to minimize adverse impacts as planned, and
- the practicability of the measure for applicant implementation, including consideration of personnel safety, and practicality of implementation.

Based on our evaluation of these proposed measures, NMFS has determined that the mitigation measures provide the means of effecting the least practicable adverse impacts on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Emergency Shut-down Related to Marine Mammal Injury and Mortality

If there is clear evidence that a marine mammal is injured or killed as a result of the proposed Navy training activities (e.g., instances in which it is clear that munitions explosions caused the injury or death), the Naval activities shall be immediately suspended and the situation immediately reported by personnel involved in the activity to the officer in charge of the training, who will follow Navy procedures for reporting the incident to NMFS through the Navy's chain-of-command.

Monitoring and Reporting Measures

Monitoring Measures

In order to issue an ITA for an activity, Section 101(a)(5)(D) of the MMPA states that NMFS must set forth "requirements pertaining to the monitoring and reporting of such taking". The MMPA implementing regulations at 50 CFR § 216.104 (a)(13) indicate that requests for IHAs must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present. The monitoring and reporting measures for the Navy's proposed SSTC training exercises are provided below.

The SSTC Monitoring Program, proposed by the Navy as part of its IHA application, is focused on mitigation based monitoring and presented more fully in Appendix A of the Navy's IHA application. Main monitoring techniques include use of civilian scientists as marine mammal observers during a sub-set of SSTC underwater detonation events to validate the Navy's pre and post event mitigation effectiveness, and observe marine mammal reaction, or lack of reaction to SSTC training events. Also, as stated in the Mitigation section, the Navy is required to conduct an acoustic monitoring project during the first field deployment of the ELCAS to the SSTC.

Monitoring methods for the SSTC training exercise include:

- Marine Mammal Observers (MMO) at SSTC underwater detonations
- ELCAS underwater noise propagation monitoring project
- Leverage aerial monitoring from other Navy-funded monitoring

NMFS has reviewed the Navy's SSTC Monitoring Program and worked with the Navy and developed the following monitoring measures for SSTC training activities.

I. Marine Mammal Observer at a Sub-set of SSTC Underwater Detonations

Civilian scientists acting as MMOs shall be used to observe a sub-set of the SSTC underwater detonation events. The goal of MMOs is two-fold. One, to validate the suite of SSTC specific mitigation measures applicable to a sub-set of SSTC training events, and to observe marine mammal behavior in the vicinity of SSTC training events.

MMOs shall be field-experienced observers that are either Navy biologists or contracted marine biologists. These civilian MMOs shall be placed either alongside existing Navy SSTC operators during a sub-set of training events, or on a separate small boat viewing platform. Use of MMOs shall verify Navy mitigation efforts within the SSTC, offer an opportunity for more detailed species identification, provide an opportunity to bring animal protection awareness to Navy personnel at SSTC, and provide the opportunity for an experienced biologist to collect data on marine mammal behavior. Data collected by the MMOs is anticipated to integrate with a Navy-wide effort to assess Navy training impacts on marine mammals (DoN 2009). Events selected for MMO participation shall be an appropriate fit in terms of security, safety, logistics, and compatibility with Navy underwater detonation training.

MMOs shall collect the same data currently being collected for more elaborate offshore ship-based observations including but not limited to:

(1) location of sighting;

(2) species;

(3) number of individuals;

(4) number of calves present;

(5) duration of sighting;

(6) behavior of marine animals sighted;

(7) direction of travel;

(8) environmental information associated with sighting event including Beaufort sea state, wave height, swell direction, wind direction, wind speed, glare, percentage of glare, percentage of cloud cover; and

(9) when in relation to Navy training did the sighting occur [before, during or after the detonation(s)].

The MMOs will not be part of the Navy's formal reporting chain of command during their data collection efforts. Exceptions shall be made if a marine mammal is observed by the MMO within the SSTC specific mitigation zones the Navy has formally proposed to the NMFS. The MMO shall inform any Navy operator of the sighting so that appropriate action may be taken by the Navy trainees.

II. ELCAS Visual Monitoring

The Navy shall place monitoring personnel to note any observations during the entire pile driving sequence, including "soft start" period, for later analysis. This analysis could provide information regarding the effectiveness of prescribing soft start or ramp up as a mitigation measures for pile driving and removal. Information regarding species observed during pile driving and removal events (including soft start period) shall include:

(1) location of sighting;

(2) species;

(3) number of individuals;

(4) number of calves present;

(5) duration of sighting;

(6) behavior of marine animals sighted;

(7) direction of travel;

(8) environmental information associated with sighting event including Beaufort sea state, wave height, swell direction, wind direction, wind speed, glare, percentage of glare, percentage of cloud cover; and

(9) when in relation to Navy training did the sighting occur (before, during or after the pile driving or removal).

III. ELCAS Acoustic Monitoring:

The Navy shall conduct underwater acoustic propagation monitoring during the first available ELCAS deployment at the SSTC. This acoustic monitoring would provide empirical field data on ELCAS pile driving and removal underwater source levels, and propagation specific to ELCAS training at the SSTC. These results shall be used to either confirm or refine the Navy's exposure predictions (source level, F value, exposures) described earlier.

IV. Leverage from Existing Navy-funded Marine Mammal Research

The Navy shall report results obtained annually from the Southern California Range Complex Monitoring Plan (DoN 2009) for areas pertinent to the SSTC. In the Navy's 2011 Letter of Authorization renewal application and subsequent Year 3 Southern California Monitoring Plan (DoN 2010), a new study area for aerial visual survey was created. This area would start at the shoreline of the oceanside Boat Lanes at SSTC and extend seaward to approximately 10 nm offshore. The goal of these aerial visual surveys is to document marine mammal occurrence within a given sub-area off Southern California. Significant surface area can be covered by a survey aircraft flying at 800 to 1,000 feet for approximately five hours. The use of both airplanes and helicopters as aerial platforms will be considered for the survey area off SSTC. Both aircraft type, in particular the helicopter, provide excellent platforms for documenting marine mammal behaviors and through digital photography and digital video.

Reporting Measures

In order to issue an ITA for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must set forth "requirements pertaining to the monitoring and reporting of such taking." Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

I. General Notification of Injured or Dead Marine Mammals

Navy personnel shall ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as clearance procedures allow) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, any Navy training exercises involving underwater detonations or pile driving. The Navy shall provide NMFS with species or description of the animal(s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available).

II. Final Report

The Navy shall submit a final report to the Office of Protected Resources, NMFS, no later than 90 days after the expiration of the IHA. The report shall, at a minimum, include the following marine mammal sighting information:

(1) location of sighting;

(2) species;

(3) number of individuals;

(4) number of calves present;

(5) duration of sighting;

(6) behavior of marine animals sighted;

(7) direction of travel;

(8) environmental information associated with sighting event including Beaufort sea state, wave height, swell direction, wind direction, wind speed, glare, percentage of glare, percentage of cloud cover; and

(9) when in relation to Navy training did the sighting occur [before, during or after the detonation(s)].

In addition, the Navy shall provide the information for all of its underwater detonation events and ELCAS events under the IHA. The information shall include: (1) total number of each type of underwater detonation events conducted at the SSTC, and (2) total number of piles driven and extracted during the ELCAS exercise.

The Navy shall submit to NMFS a draft report as described above and shall respond to NMFS comments within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or three months after the submittal of the draft if NMFS does not comment by then.

Estimated Take by Incidental Harassment

<u>Estimated Marine Mammal Exposures from SSTC Underwater Detonations</u>

The quantitative exposure modeling methodology estimated numbers of individuals exposed to the effects of underwater detonations exceeding the thresholds used, as if no mitigation measures were employed.

All estimated exposures are seasonal averages (mean) plus one standard deviation using 1/2 of the yearly training tempo to represent each season. Taking this approach was an effort to be conservative (i.e., allow for an overestimate of exposure) when estimating exposures typical of training during a single year.

Table 4 shows number of annual predicted exposures by species for all underwater detonation training within the SSTC. As stated previously, only events with sequential detonations were examined for non-TTS behavior disruption.

Table 4. SSTC Modeled Estimates of Species Exposed to Underwater Detonations without Implementation of Mitigation Measures.

Species		Annual Marine Mammal Exposure (All Sources)			
		Level B Behavior (Multiple Successive Explosive Events Only)	Level B TTS	Level A	Mortality
		177 dB re 1 μPa	182 dB re 1 μPa^2-s / 23 psi	205 dB re 1 μPa^2-s / 13.0 psi-ms	30.5 psi-ms
Gray Whale	Warm	-	-	-	-
	Cold	0	0	0	0
Bottlenose Dolphin	Warm	30	43	0	0
	Cold	40	55	0	0
California Sea Lion	Warm	4	4	0	0
	Cold	40	51	0	0
Harbor Seal	Warm	0	0	0	0
	Cold	0	0	0	0
Long-beaked common dolphin	Warm	14	21	0	0
	Cold	7	10	0	0
Pacific white-sided dolphin	Warm	2	3	0	0
	Cold	3	4	0	0
Risso's dolphin	Warm	3	4	0	0
	Cold	11	15	0	0
Short-beaked common dolphin	Warm	123	177	0	0
	Cold	62	86	0	0
Total Annual Exposures		**453**	**626**	**0**	**0**

In summary, for all underwater detonations, the Navy's impact model predicted that no marine mammal mortality and/or Level A harassment (injury) would occur within the proposed action area. The mitigation requirements are expected to ensure that this is the case.

For non-sequential (i.e., single detonation) training events, the Navy's impact model predicted a total of 626 annual exposures that could result in Level B harassment (TTS), which include annual exposures of 98 bottlenose dolphins, 55 California sea lions, 31 long-beaked common dolphins, 7 Pacific white-sided dolphins, 19 Risso's dolphins, and 263 short-beaked common dolphins.

For sequential (Multiple Successive Explosive events) training events, the Navy's impact model predicted a total of 453 annual exposures that could result in Level B behavioral harassment, which include annual exposures of 70 bottlenose dolphins, 44 California sea lions, 21 long-beaked common dolphins, 5 Pacific white-sided dolphins, 14 Risso's dolphins, and 185 short-beaked common dolphins.

<u>Estimated Marine Mammal Exposures from ELCAS Pile Driving and Removal</u>

I. Pile Driving

Using the marine mammal densities presented in the Navy's IHA application, the number of animals exposed to annual Level B harassment from ELCAS pile driving can be estimated. A couple of business rules and assumptions are used in this determination:

1. Pile driving is estimated to occur 10 days per ELCAS training event, with up to four training exercises being conducted per year (40 days per year). Given likely variable training schedules, an assumption was made that approximately 20 of these 40 days would occur during the warm water season, and 20 of the 40 days would occur during the cold water season.
2. To be more conservative even to the point of over predicting likely exposures, the Navy asserts that during the calculation there can be no "fractional" exposures of marine mammals on a daily basis, and all exposure values are rounded up during the calculation.

To estimate the potential ELCAS pile driving exposure, the following expression is used:

Annual exposure = ZOI × warm season marine mammal density × warm season pile driving days + ZOI × cold season marine mammal density × cold season pile driving days, with ZOI = $\pi \times R^2$, where R is the radius of the ZOI.

An example showing the take calculation for bottlenose dolphins, with the conservative "daily rounding up" business rule (#2 above), is shown below:

Daily exposure = $\pi \times 0.999^2 \times 0.202 + \pi \times 0.999^2 \times 0.202 = 0.6 + 0.6$.

When rounding up the daily exposure 0.6 dolphin to 1 dolphin; the annual exposure from warm season pile driving days (20 days) and cold season pile driving days (20 days) is:

Annual exposure = $1 \times 20 + 1 \times 20 = 40$

Based on the assessment using the methodology discussed previously, applying the business rules and limitations described here, and without consideration of mitigation measures, the take estimate is that ELCAS pile driving is predicted to result in no Level A Harassments to any marine mammal (received SPL of 190 dB_{rms} for pinnipeds and 180 dB_{rms} re 1 µPa for cetacean, respectively) but 40 bottlenose dolphins, 20 California sea lions, and 80 short-beaked common dolphins by Level B behavioral harassment (Table 5).

II. Pile Removal

The same approach is applied for take estimation from ELCAS pile removal.

To estimate the potential ELCAS pile removal exposure, the following expression is used:

Annual exposure = ZOI × warm season marine mammal density × warm season pile removal days + ZOI × cold season marine mammal density × cold season pile removal days, with ZOI = $\pi \times R^2$, where R is the radius of the ZOI.

An example showing the take calculation for bottlenose dolphins, with the conservative "daily rounding up" business rule for pile removal, is shown below:

Daily exposure = $\pi \times 4.64^2 \times 0.202 + \pi \times 4.64^2 \times 0.202 = 13.7 + 13.7$.

When rounding up the daily exposure 13.7 dolphins to 14 dolphins; the annual exposure from warm season pile removal days (6 days) and cold season pile removal days (6 days) is:

Annual exposure = $14 \times 6 + 14 \times 6 = 168$

Based on the assessment using the methodology discussed previously, applying the business rules and limitations described here, and without consideration of mitigation measures, the take estimate is that ELCAS pile removal is predicted to result in no Level A Harassments to any marine mammal (received SPL of 190 dB_{rms} for pinnipeds and 180 dB_{rms} re 1 µPa for cetacean, respectively) but in Level B behavioral harassment of 168 bottlenose dolphins, 102 California sea lions, 12 harbor seals, 6 gray whales, 54 long-beaked common dolphins, 12 Pacific white-sided dolphins, 30 Risso's dolphins, and 462 short-beaked common dolphins (Table 5).

Table 5. Exposure Estimates from ELCAS Pile Driving and Removal Prior to Implementation of Mitigation Measures.

Species		Annual Marine Mammal Exposure (All Sources)			
		Level B Behavior (Non-Impulse)	Level B Behavior (Impulse)	Level A (Cetacean)	Level A (Pinniped)
		120 dB_{rms} re 1 µPa	160 dB_{rms} re 1 µPa	180 dB_{rms} re 1 µPa	190 dB_{rms} re 1 µPa
Gray Whale	Installation	N/A	0	0	0
	Removal	6	N/A	0	0
Bottlenose Dolphin	Installation	N/A	40	0	0
	Removal	168	N/A	0	0
California Sea Lion	Installation	N/A	20	0	0
	Removal	102	N/A	0	0
Harbor Seal	Installation	N/A	0	0	0
	Removal	12	N/A	0	0
Long-beaked common dolphin	Installation	N/A	0	0	0
	Removal	54	N/A	0	0
Pacific white-sided dolphin	Installation	N/A	0	0	0
	Removal	12	N/A	0	0
Risso's dolphin	Installation	N/A	0	0	0
	Removal	30	N/A	0	0
Short-beaked common dolphin	Installation	N/A	80	0	0
	Removal	462	N/A	0	0
Total Annual Exposures		**846**	**140**	**0**	**0**

In summary, for all underwater detonations and ELCAS pile driving activities, the Navy's impact model predicted that no mortality and/or Level A harassment (injury) would occur to marine mammal species and stocks within the proposed action area.

Potential Impacts to Marine Mammal Habitat

The proposed training activities at SSTC will not result in any permanent impact on habitats used by marine mammals, and potentially short-term to minimum impact to the food sources such as forage fish. There are no known haul-out sites, foraging hotspots, or other ocean bottom structures of significant biological importance to harbor seals, California sea lions, or bottlenose dolphins within SSTC. Therefore, the main impact associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on marine mammals, as discussed previously.

The primary source of effects to marine mammal habitat is exposures resulting from underwater detonation training and ELCAS pile driving and removal training events. Other sources that may affect marine mammal habitat include changes in transiting vessels, vessel strike, turbidity, and introduction of fuel, debris, ordnance, and chemical residues. However, each of these components was addressed in the SSTC Environmental Impact Statement (EIS) and it is the Navy's assertion that there would be no likely impacts to marine mammal habitats from these training events.

The most likely impact to marine mammal habitat occurs from underwater detonation and pile driving and removal effects on likely marine mammal prey (i.e., fish) within SSTC.

There are currently no well-established thresholds for estimating effects to fish from explosives other than mortality models. Fish that are located in the water column, in proximity to the source of detonation could be injured, killed, or disturbed by the impulsive sound and could leave the area temporarily. Continental Shelf Inc. (2004) summarized a few studies conducted to determine effects associated with removal of offshore structures (e.g., oil rigs) in the Gulf of Mexico. Their findings revealed that at very close range, underwater explosions are lethal to most fish species regardless of size, shape, or internal anatomy. In most situations, cause of death in fish has been massive organ and tissue damage and internal bleeding. At longer range, species with gas-filled swimbladders (e.g., snapper, cod, and striped bass) are more susceptible than those without swimbladders (e.g., flounders, eels).

Studies also suggest that larger fish are generally less susceptible to death or injury than small fish. Moreover, elongated forms that are round in cross section are less at risk than deep-bodied forms. Orientation of fish relative to the shock wave may also affect the extent of injury. Open water pelagic fish (e.g., mackerel) seem to be less affected than reef fishes. The results of most studies are dependent upon specific biological, environmental, explosive, and data recording factors.

The huge variation in fish populations, including numbers, species, sizes, and orientation and range from the detonation point, makes it very difficult to accurately predict mortalities at any specific site of detonation. All underwater detonations are of small scale (under 29 lbs NEW), and the proposed training exercises would be conducted in several areas within the large SSTC Study Area over the seasons during the year. Most fish species experience a large number of natural mortalities, especially during early life-stages, and any small level of mortality caused by the SSTC training exercises involving explosives will likely be insignificant to the population as a whole.

Therefore, potential impacts to marine mammal food resources within the SSTC are expected to be minimal given both the very geographic and spatially limited scope of most Navy at-sea activities including underwater detonations, and the high biological productivity of these resources. No short or long term effects to marine mammal food resources from Navy activities are anticipated within the SSTC Study Area.

Subsistence Harvest of Marine Mammals

NMFS has determined that the Navy's proposed training activities at the SSTC would not have an unmitigable adverse impact on the availability of the affected species or stocks for subsistence use since there are no such uses in the specified area.

Negligible Impact and Small Numbers Analysis and Determination

Pursuant to NMFS' regulations implementing the MMPA, an applicant is required to estimate the number of animals that will be "taken" by the specified activities (i.e., takes by harassment only, or takes by harassment, injury, and/or death). This estimate informs the analysis that NMFS must perform to determine whether the activity will have a "negligible impact" on the species or stock. Level B (behavioral) harassment occurs at the level of the individual(s) and does not assume any resulting population-level consequences, though there are known avenues through which behavioral disturbance of individuals can result in population-level effects. A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (i.e., population-level effects). An estimate of the number of Level B harassment takes alone is not enough information on which to base an impact determination.

In addition to considering estimates of the number of marine mammals that might be "taken" through behavioral harassment, NMFS considers other factors, such as the likely nature of any responses (their intensity, duration, etc.), the context of any responses (critical reproductive time or location, migration, etc.), as well as the number and nature of estimated Level A takes, the number of estimated mortalities, and effects on habitat.

The Navy's specified activities have been described based on best estimates of the planned training exercises at SSTC action area. Some of the noises that would be generated as a result of the proposed underwater detonation and ELCAS pile driving activities, are high intensity. However, the explosives that the Navy plans to use in the proposed SSTC action area are all small detonators under 29 lbs NEW, which result in relatively small ZOIs. In addition, the locations where the proposed training activities are planned are shallow water areas which would effectively contain the spreading of explosive energy within the bottom boundary. Taking the above into account, along with the fact that NMFS anticipates no mortalities and injuries to result from the action, the fact that there are no specific areas of reproductive importance for marine mammals recognized within the SSTC area, the sections discussed below, and dependent upon the implementation of the proposed mitigation measures, NMFS has determined that Navy training exercises utilizing underwater detonations and ELCAS pile driving and removal will have a negligible impact on the affected marine mammal species and stocks present in the SSTC Study Area.

NMFS' analysis of potential behavioral harassment, temporary threshold shifts, permanent threshold shifts, injury, and mortality to marine mammals as a result of the SSTC training activities was provided earlier in this document and is analyzed in more detail below.

<u>Behavioral Harassment</u>

As discussed earlier, the Navy's proposed SSTC training activities would use small underwater explosives with maximum NEW of 29 lbs 16 events per year in areas of small ZOIs that would mostly eliminate the likelihood of mortality and injury to marine mammals. In addition, these detonation events are widely dispersed in several designated sites within the SSTC Study Area. The probability that detonation events will overlap in time and space with marine mammals is low, particularly given the densities of marine mammals in the vicinity of SSTC Study Area and the implementation of monitoring and mitigation measures. Moreover, NMFS does not expect animals to experience repeat exposures to the same sound source as animals will likely move away from the source after being exposed. In addition, these isolated exposures, when received at distances of Level B behavioral harassment (i.e., 177 dB re 1 μPa^2-s), are expected to cause brief startle reactions or short-term behavioral modification by the animals. These brief reactions and behavioral changes are expected to disappear when the exposures cease. Therefore, these levels of received impulse noise from detonation are not expected to affect annual rates or recruitment or survival.

TTS

NMFS and the Navy have estimated that individuals of some species of marine mammals may sustain some level of temporary threshold shift TTS from underwater detonations. TTS can last from a few minutes to days, be of varying degree, and occur across various frequency bandwidths. The TTS sustained by an animal is primarily classified by three characteristics:

- Frequency – Available data (of mid-frequency hearing specialists exposed to mid to high frequency sounds- Southall et al. 2007) suggest that most TTS occurs in the frequency range of the source up to one octave higher than the source (with the maximum TTS at ½ octave above).
- Degree of the shift (i.e., how many dB is the sensitivity of the hearing reduced by) – generally, both the degree of TTS and the duration of TTS will be greater if the marine mammal is exposed to a higher level of energy (which would occur when the

peak dB level is higher or the duration is longer). Since the impulse from detonation is extremely brief, an animal would have to approach very close to the detonation site to increase the received SEL. The threshold for the onset of TTS for detonations is a dual criteria: 182 dB re 1 μPa^2-s or 23 psi, which might be received at distances from 20 – 490 yards from the centers of detonation based on the types of NEW involved to receive the SEL that causes TTS compared to similar source level with longer durations (such as sonar signals).

- Duration of TTS (Recovery time) – Of all TTS laboratory studies, some using exposures of almost an hour in duration or up to SEL at 217 dB re 1 μPa^2-s, almost all recovered within 1 day (or less, often in minutes), though in one study (Finneran et al. 2007), recovery took 4 days.

Although the degree of TTS depends on the received noise levels and exposure time, all studies show that TTS is reversible and animals' sensitivity is expected to recover fully in minutes to hours based on the fact that the proposed underwater detonations are small in scale and isolated. Therefore, NMFS expects that TTS would not affect annual rates of recruitment or survival.

Acoustic Masking or Communication Impairment

As discussed above, it is also possible that anthropogenic sound could result in masking of marine mammal communication and navigation signals. However, masking only occurs during the time of the signal (and potential secondary arrivals of indirect rays), versus TTS, which occurs continuously for its duration. Impulse sounds from underwater detonation and pile driving are brief and the majority of most animals' vocalizations would not be masked. Although impulse noises such as those from underwater explosives and impact pile driving tend to decay at distance, and thus become non-impulse, give the area of extremely shallow water (which effectively attenuates low frequency sound of these impulses) and the small NEW of explosives, the SPLs at these distances are expected to be barely above ambient level. Therefore, masking effects from underwater detonation are expected to be minimal and unlikely. If masking or communication impairment were to occur briefly, it would be in the frequency ranges below 100 Hz, which overlaps with some mysticete vocalizations; however, it would likely not mask the entirety of any particular vocalization or communication series because of the short impulse.

PTS, Injury, or Mortality

The modeling for take estimates predict that no marine mammal would be taken by Level A harassment (injury, PTS included) or mortality due to the low power of the underwater detonation and the small ZOIs. Further, the mitigation measures have been designed to ensure that animals are detected in time to avoid injury or mortality when TDFDs are used, in consideration of swim speed.

Based on these assessments, NMFS determined that approximately 6 gray whales, 221 California sea lions, 12 harbor seals, 323 bottlenose dolphins, 106 long-beaked common dolphins, 24 Pacific white-sided dolphins, 63 Risso’s dolphins, and 990 short-beaked common dolphins could be affected by Level B harassment (TTS and sub-TTS) as a result of the proposed SSTC training activities.

Additionally, as discussed previously, the aforementioned take estimates do not account for the implementation of mitigation measures. With the implementation of mitigation and monitoring measures, NMFS expects that the takes would be reduced further. Coupled with the fact that these impacts will likely not occur in areas and times critical to reproduction, NMFS has determined that the total taking incidental to the Navy's proposed SSTC training activities would have a negligible impact on the marine mammal species and stocks present in the SSTC Study Area.

Endangered Species Act (ESA)

No marine mammal species are listed as endangered or threatened under the ESA with confirmed or possible occurrence in the study area. Therefore, section 7 consultation under the ESA for NMFS's proposed issuance of an MMPA authorization is not warranted.

National Environmental Policy Act (NEPA)

The Navy has prepared a Final Environmental Impact Statement (EIS) for the proposed SSTC training activities. The FEIS was released in January 2011 and it is available at http://www.silverstrandtrainingcomplexeis.com/EIS.aspx/. NMFS was a cooperating agency (as defined by the Council on Environmental Quality (40 CFR 1501.6)) in the preparation of the EIS. NMFS subsequently adopted the FEIS for the SSTC training activities.

As a result of these determinations, NMFS has issued an IHA to the Navy to conduct training activities at the SSTC Study Area, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

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Wanda Cain,
Acting Director,
Office of Protected Resources,
National Marine Fisheries Service.

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